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**200-BP-1 SITE INVESTIGATION  
ANALYTICAL CHEMISTRY SUPPORT PROJECT**

**TASKS 2 & 4**

**DATA PACKAGE/REPORT No. 18**

**Revision 0**

**October 12, 1992**



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**Pacific Northwest Laboratory**

**(PNL Project #16772)**

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INTRODUCTION

This data package contains the results obtained by Pacific Northwest Laboratory (PNL) staff in the characterization of samples for the 200-BP-1 Site Investigation Analytical Chemistry Support Project. The samples were submitted for analysis by Westinghouse Hanford Company (WHC) under the Technical Project Plan (TPP) 16772 and the Quality Assurance Project Plan (QAPjP) ALO-001. The analytical procedures required for analysis were defined in the Test Instructions (TI) prepared by the PNL 200-BP-1 Project Management Office in accordance with the TPP and the QAPjP ALO-001.

The samples (Table 1) were submitted with the appropriate WHC Chain of Custody (COC) and Sample Analysis Request Forms. The samples were delivered at refrigerated temperature (i.e., packed in ice in coolers) to the 300 Area, 325 Building and 329 Building 200-BP-1 Sample Custodians.

The requested analyses for samples # 92-06428, 92-06713, 92-06726, 92-06727 and 92-06904 are the full suite as specified in the WHC SOW. The full suite of analyses parameters of interest are; nitrate, nitrite, phosphate, sulfate, cyanide, free cyanide, complex cyanide, bismuth, the EPA Contract Laboratory Program inorganic target analytes, total alpha, total beta, cesium-137, cobalt-60, ruthenium-106, plutonium-239/240, plutonium-238, strontium-90, technetium-99, total uranium activity, tritium, total organic carbon and the EPA Contract Laboratory Program organic target compound list. The other seven samples were submitted for total and free cyanide analyses. Weight percent solids is also determined for soil samples (see Table 2). All data are corrected to dry weight except where otherwise stated. The quality control (QC) requirements for the samples are defined in the test instructions for each sample. The QC requirements outlined in the procedures and requested in the WHC SOW were followed. Method blanks, matrix spikes, sample duplicates and/or matrix spike duplicates were analyzed. All QC data that exist are included in the appendices of this Data Package/Report.

The data in this package are reported in separate tables or CLP Forms (Tables 2 through 16 and CLP Forms) for each analyte or method. Five appendices are provided; one for Test Instruction, one for Chain of Custody, Sample Analysis Request Forms and Sample Receipt Forms, one that contains the

primary inorganic analytical data, one that contains the primary radiochemistry analytical data, and one that contains the primary organic analytical data and full CLP data tables.



CERTIFICATION STATEMENT

I certify that this data package is in compliance with the terms and conditions of the TPP 16772 and QAPjP ALO-001 for completeness. Release of the data contained in this hard copy data package and in the computer-readable data submitted on floppy diskette has been authorized by the Project Manager or the Project Manager's designee, as verified by the following signature.

B. M. Gillespie  
B. M. Gillespie  
200-BP-1 Project Manager

10/12/92  
Date



TABLE 1: 200-BP-1 Sample Numbers

<u>WHC</u> <u>Sample Number</u>	<u>PNL ALO</u> <u>Sample Number</u>	<u>Sample Type</u>	<u>*Analyses</u> <u>Requested</u>
B067Y5	92-06428	Soil	Full Suite
B067Y7	92-06713	Soil	Full Suite
B067Z0	92-06724	Soil	CN Suite
B067Z2	92-06725	Soil	CN Suite
B067Z3	92-06726	Soil	Full Suite
B067Z5	92-06727	Soil	Full Suite
B067Z8	92-06862	Soil	CN Suite
B06800	92-06863	Soil	CN Suite
B06802	92-06864	Soil	CN Suite
B06804	92-06865	Soil	CN Suite
B06809	92-06904	Soil	Full Suite
B06812	92-06905	Soil	CN Suite

\* CN Suite - Total CN, Free CN and Complex CN  
 Full Suite - Anions, Bismuth, CLP Inorganic Target Analytes,  
 Radiochemistry Suite, TOC and CLP Organic Target Compounds  
 (as defined in Introduction, pg 2.)

TABLE 2:  
WEIGHT PERCENT SOLIDS SUMMARY SHEET

SAMPLE ID#	PNL LOG#	SAMPLE WT %	DUPLICATE WT %	AVERAGE SOLIDS WT %
B067Y5 4/29/92	92-06428	97.00	96.83	96.9
5/14/92	92-06428	96.92	96.69	96.8
B067Y7 4/29/92	92-06713	97.42	97.43	97.4
5/14/92	92-06713	97.24	97.72	97.5
B067Z0	92-06724	95.44	96.26	95.9
B067Z2	92-06725	95.88	96.04	96.0
B067Z3	92-06726	96.63	96.67	96.7
B067Z5	92-06727	97.78	97.82	97.8
B067Z8	92-06862	96.12	95.54	95.8
B06800	92-06863	96.81	96.92	96.9
B06802	92-06864	96.24	95.87	96.1
B06804	92-06865	95.43	95.49	95.5
B06809	92-06904	97.45	98.09	97.8
B06812	92-06905	97.09	97.21	97.2

Note: Weight Percent Solids were determined following the method outlined in PNL-ALO-504.

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ANION ANALYSIS RESULTS

Samples 92-06428/B067Y5, 92-06713/B067Y7, 92-06726/B067Z3, 92-06727/B067Z5, and 92-06904/B06809 from SDG #18 as well as samples from SDG #19 were extracted using procedure PNL-ALO-108(Rev 0) and were analyzed using procedure PNL-ALO-212(Rev 0), in accordance with EPA Method 300.0. Sample 92-06964/B06815 (SDG #19) was selected as the batch QC sample for spiking. The sample preparation and analysis were performed in the 325 building in the 300 area.

Data presentation (see Table 3A-3D, and the notes below)

Each anion has been listed on a separate page with sample, sample duplicate, matrix spike, duplicate matrix spike, and control standard information.

RPD values for samples analyzed in duplicate, spike recoveries for spiked samples, and control standard recoveries have also been reported. For soil samples, all analyte values, spike levels, and recoveries were based on dry weights.

The control standard for all anions has been defined as the spiked (method) blank.

Concentration flags ( C ) and quality flags ( Q ) have also been appended, where appropriate.

CRDL and IDL values

<u>Analyte</u>	<u>CRDL</u>		<u>IDL</u>	
	<u>µg/L</u>	<u>mg/kg</u>	<u>µg/L</u>	
Nitrite-N	15	1	8	0.8
Nitrate-N	15	1	7	0.8
Phosphate-P	60	5	30	1.7
Sulfate	250	20	51	4.0



Reported values for solids are in mg/kg . For solid samples, at an extract buffer weight to sample weight ratio of 10, the IDL values have been estimated to be 0.8xCRDL for NO<sub>2</sub>-N and NO<sub>3</sub>-N, 0.33xCRDL for PO<sub>4</sub>-P, and 0.2xCRDL for SO<sub>4</sub>.

#### Hold Times

The hold time of 48 hours after extraction (for soils) was met for all of the samples analyzed.

#### Accuracy and Precision in IC Results

The accuracy of reported values between 20-80% of the calibration maximum has been estimated to be  $\pm 10\%$ , unless otherwise noted in this report. This level of accuracy may be considered achievable throughout the calibration range unless otherwise specified. The accuracy decreases and errors increase for lower analyte levels and may be 100% at the instrument detection limit.

#### Quality Control

The criterion for the acceptance of data, that the spiked blank values for the anions of interest are quantitated within  $\pm 20\%$ , has been met. The retention time (R.T.) window for the anions of interest, set at  $\pm 10\%$ , has been met.

Sample 92-06713/B067Y7 was analyzed in duplicate with RPD values for all analytes being less than 10%.

Sample 92-06964/B06815 from SDG #19 was spiked in duplicate and recoveries of all analytes except phosphate were well within the specified recovery limits. Phosphate spike recovery was slightly low but very consistent. It was noticed that area/height ratios for phosphate on these soil samples were higher than those for the verification and calibration standards. This results in shorter, fatter peaks and because quantitation is performed using peak area, it is possible that quantitation is slightly high.

This would also indicate that some property of the sample (e.g., complexation, a matrix effect, etc.) is affecting phosphate elution and quantitation.

Recoveries of all analytes in the control standard (spiked method blank) were well within a 10% window.

TABLE 3A: ANION IC ANALYSIS DATA FOR TASKS 2 & 4 SDG 18  
NITRITE (NO2-N)

CUST ID	ALO #	C1		C2		% RPD	C5		C3		C6		% RECOVERY		
		SAMPLE (mg/Kg)	C	DUP (mg/Kg)	C		BLANK (mg/Kg)	C	SMPL+ SPIKE (mg/Kg)	SPIKE (mg/Kg)	DUP+ SPIKE (mg/Kg)	SPIKE (mg/Kg)	---C3--- SMPL SPIKE	---C6--- DUP SPIKE	---C4--- CNTRL STD.
B067Y5	92-06428	0.8	U				0.8	U							
B067Y7	92-06713	1.6		1.5		6%									
B067Z3	92-06726	48.1													
B067Z5	92-06727	43.3													
B06809	92-06904	7.0													
B06815+	92-06964	0.8	U			1%			14.1	15.6	14.2	15.6	90%	91%	93%

NOTES:

- + Not in this SDG but reported for QC purposes.
- %RPD values have been calculated using sample duplicates OR the two % spike recovery values.
- 100% extraction efficiency assumed in defining dil. factor as (diluent vol / sample wt) x 1.00 gm/ml.
- C5: Method Blank ; C4: Spiked Blank; nominal sample wt=2.00gm.
- Estimated IDL = 0.8 mg/Kg.
- CRDL= 1.0 mg/Kg.

Quality Flags [Q]

- E: Estimated value, interference present  
N: Spike recovery not within control limits  
\*: Duplicate analysis not within control limits

Concentration Flags [C]

- B: IDL <= [Analyte] < CRDL  
U: [Analyte] < IDL



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TABLE 3B: ANION IC ANALYSIS DATA FOR TASKS 2 & 4 SDG 18  
NITRATE (NO3-N)

CUST ID	ALO #	C1		C2		% RPD	C5		C3		C6		% RECOVERY		
		SAMPLE (mg/Kg)	C	DUP (mg/Kg)	C		BLANK (mg/Kg)	C	SMPL+ SPIKE (mg/Kg)	SPIKE (mg/Kg)	DUP+ SPIKE (mg/Kg)	SPIKE (mg/Kg)	SMPL SPIKE	DUP SPIKE	C4 CNTRL STD. Q
B067Y5	92-06428	23.6					0.8	U							
B067Y7	92-06713	15.7		14.8		6%									
B067Z3	92-06726	565													
B067Z5	92-06727	432													
B06809	92-06904	266													
B06815+	92-06964	2.0				1%			12.6	11.6	12.7	11.5	91%	92%	98%

NOTES:

1. + Not in this SDG but reported for QC purposes.
2. %RPD values have been calculated using sample duplicates OR the two % spike recovery values.
3. 100% extraction efficiency assumed in defining dil. factor as (diluent vol / sample wt) x 1.00 gm/ml.
4. C5: Method Blank ; C4: Spiked Blank; nominal sample wt=2.00gm.
5. Estimated IDL = 0.8 mg/Kg.
6. CRDL = 1.0 mg/Kg.

Quality Flags [Q]

- E: Estimated value, interference present  
N: Spike recovery not within control limits  
\*: Duplicate analysis not within control limits

Concentration Flags [C]

- B: IDL <= [Analyte] < CRDL  
U: [Analyte] < IDL

TABLE 3C: ANION IC ANALYSIS DATA FOR TASKS 2 & 4 SDG 18  
PHOSPHATE (PO4-P)

CUST ID	ALO #	C1 SAMPLE (mg/Kg)	C	C2 DUP (mg/Kg)	C	% RPD	C5 BLANK (mg/Kg)	C	C3		C6		% RECOVERY			Q
									SMPL+ SPIKE (mg/Kg)	SPIKE (mg/Kg)	DUP+ SPIKE (mg/Kg)	SPIKE (mg/Kg)	C3 SMPL SPIKE	C6 DUP SPIKE	C4 CNTRL STD.	
B067Y5	92-06428	40.0					1.7	U								N
B067Y7	92-06713	19.0		18.2		4%										N
B067Z3	92-06726	19.6														N
B067Z5	92-06727	7.6														N
B06809	92-06904	4.1	B													N
B06815+	92-06964	26.2				4%			37.8	16.7	37.4	16.7	69%	67%	97%	N

NOTES:

- + Not in this SDG but reported for QC purposes.
- %RPD values have been calculated using sample duplicates OR the two % spike recovery values.
- 100% extraction efficiency assumed in defining dil. factor as (diluent vol / sample wt) X 1.00 gm/ml.
- C5: Method Blank ; C4: Spiked Blank; nominal sample wt=2.00gm.
- Estimated IDL = 1.7 mg/Kg.
- CRDL= 5 mg/Kg.

Quality Flags [Q]

- E: Estimated value, interference present  
N: Spike recovery not within control limits  
\*: Duplicate analysis not within control limits

Concentration Flags [C]

- B: IDL <= [Analyte] < CRDL  
U: [Analyte] < IDL

TABLE 3D: ANION IC ANALYSIS DATA FOR TASKS 2 & 4 SDG 18  
SULFATE (SO4)

CUST ID	ALO #	C1		C	C2		C	% RPD	C5		C	C3		C6		% RECOVERY			Q
		SAMPLE (mg/Kg)			DUP (mg/Kg)				BLANK (mg/Kg)			SMPL+ SPIKE (mg/Kg)	SPIKE (mg/Kg)	DUP+ SPIKE (mg/Kg)	SPIKE (mg/Kg)	C3 SMPL SPIKE	C6 DUP SPIKE	C4 CNTRL STD.	
B067Y5	92-06428	67.0									4 U								
B067Y7	92-06713	45.7			43.4			5%											
B0667Z3	92-06726	127																	
B067Z5	92-06727	171																	
B06809	92-06904	200																	
B06815+	92-06964	37.8						5%				91.2	51.2	88.8	51.1	104%	100%	96%	

NOTES:

- + Not in this SDG but reported for QC purposes.
- %RPD values have been calculated using sample duplicates OR the two % spike recovery values.
- 100% extraction efficiency assumed in defining dil. factor as (diluent vol / sample wt) X 1.00 gm/ml.
- C5: Method Blank ; C4: Spiked Blank; nominal sample wt=2.00gm.
- Estimated IDL= 4 mg/Kg.
- CRDL= 20 mg/Kg.

Quality Flags [Q]

- E: Estimated value, interference present  
N: Spike recovery not within control limits  
\*: Duplicate analysis not within control limits

Concentration Flags [C]

- B: IDL <= [Analyte] < CRDL  
U: [Analyte] < IDL



CYANIDE ANALYSIS RESULTS

Total cyanide analysis was performed in room 313 of building 325 in the Hanford Site 300 area. This data package includes cyanide results for 12 soil-sediment samples. Cyanide results for Task 2&4 SDG #18 are presented by colorimetric analysis run batch. Results are summarized in Table 4 (Soils/Sediments).

Total cyanide results for soil-sediment samples and corresponding duplicates (where applicable) were below the instrument detection limit (IDL) of 0.2 mg/kg for samples B06770, B067Z2, B067Z8, B06800, B06802, and B06804. The "measured" concentration for samples B067Y7, B067Z3, B06809, and B06812 were below the CRDL of 1.0 mg/Kg but above the IDL; sample B06809 actually calculated above the CRDL because the radioactive level required a reduced sample size of about 2 gm instead of the usual 5 gm. Only samples B067Z5 and B067Y5 had CN concentrations above the CRDL; the results being 1.9 and 248.5 mg/kg, respectively. Sample B067Y5 was the only sample in this SDG requiring free cyanide analysis. The 12 day hold time specified for cyanide analysis under the CLP protocol was met for all samples in this data package.

Accuracy and precision can be inferred from the recovery data for the distilled CN laboratory control standard; i.e., ICV-6 (LCS-0789), prepared by ICF Corporation. The average CN recovery for the laboratory control sample analyzed with the soil-sediment samples was 106% with a standard deviation of 3%. Recovery value for ICV-6 is based on the spiking of 2 ml of stock standard ICV-6 to 500 ml of deionized water and recovery back calculated to the original ICV-6 cyanide concentration.

The average spiked soil-sediment sample CN recovery for the twelve samples was 100% with a standard deviation of 5%.

Total cyanide found in water blanks analyzed for each analysis set within the data package were below the IDL. The IDL for liquids in the colorimetric cyanide analysis procedure is 2 µg/L, based on the EPA CLP approved procedure for determining IDL. For solids the comparable colorimetric cyanide IDL is 0.2 mg/kg, assuming a sample weight of 5 g.

TABLE 4: TOTAL CYANIDE ANALYSIS DATA FOR TASKS 2 & 4  
SDG #18

SOILS-SEDIMENTS		Sample G1 (mg/kg)	C	Sample Dup G2 (mg/kg)	C	RPD	Blank G5 (µg/L)	C	Spike added (µg)	Sample + Spike G3 (mg/kg)	ICV G4 (mg/L)	%Recoveries Smpl + Spk G3      ICV G4		Q	Footnotes
B067Z0	92-06724	0.2	U	0.2	U	N/A	2.0	U	49.1	10.5	9.7	102%	103%		1-5
B067Y5	92-06428	249													2,3,5
B067Z2	92-06725	0.2	U	0.2	B	N/A	2.0	U	49.1	10.5	9.9	101%	105%		1-5
B067Y7	92-06713	0.8	B												2,3,5
B067Z3	92-06726	0.8	B	0.6	B	25%	2.0	U	49.1	25.9	10.2	102%	109%		1-5
B067Z5	92-06727	1.9													2,3,5
B067Z8	92-06862	0.2	U	0.2	U	N/A	2.0	U	49.1	10.4	10.0	101%	106%		1-5
B06800	92-06863	0.2	U												2,3,5
B06802	92-06864	0.2	U	0.2	U	N/A	2.0	U	49.1	10.7	10.3	105%	109%		1-5
B06804	92-06865	0.2	U												2,3,5
B06809	92-06904	1.4	B	1.1	B	24%	2.0	U	49.3	22.5	9.6	90%	102%		1-5
B06812	92-06905	0.9	B												2,3,5
												Mean Std Dev	100% 5%	106% 3%	

## Footnotes

1. Stock ICV-6=9.4 mg/L; 2 mL (18.8 µg CN) added to distillation flask & recovered in 250 mL NaOH.
2. Contract required detection limit for soil-sediment = 1.0 mg/kg.
3. IDL for solids is 0.2 mg/kg based on 5 g sample; Sample IDL adjusted for weight used.
4. RPD must be within one CRDL when either sample or duplicate are below 5X CRDL.
5. C Flags: U= <IDL, B= <CRDL but =>IDL; Q Flags: N= Spike Recovery Failed, \*= RPD failed.



FREE CYANIDE ANALYSIS RESULTS

The sample in this sample delivery group was extracted using procedure PNL-ALO-107 and were analyzed using procedure PNL-ALO-271, which was derived from Dionex Application Update 107. The sample preparation and analysis were performed in the 325 building in the 300 Area. The single sample from SDG #18 requiring free CN analysis and other samples from SDG #17, #18 and #19 were analyzed in this analytical run. One sample from SDG #17 was selected as the Batch QC sample for spiking.

Data presentation (See Table 5 and notes below)

Each sample is listed on a separate line with sample, sample duplicate matrix spike, duplicate matrix spike, and control standard information.

RPD values for samples analyzed in duplicate, spike recoveries for spiked samples and control standard recoveries are also reported. For soil samples, all analyte values, spike levels, and recoveries are based on dry weights.

The control standard is the spiked method blank.

Concentration flags (C) and quality flags (Q) are also appended, where appropriate.

CRDL and IDL values

CRDL = 10  $\mu\text{g/L}$ , 1 mg/Kg; IDL = 5  $\mu\text{g/L}$ , 0.5 mg/Kg

Reported values for solids are in mg/Kg. The IDL values are estimated at  $0.5 \times \text{CRDL}$  in the liquid and assumes a 100-fold dilution during extraction for solid samples.



### Hold Times

The hold time, analysis within 12 days following sample receipt, was not met for sample 92-06428/B067Y5 (SDG #18). This sample missed the 12 day hold time by 11 days. Since the results are similar to those from samples in SDG #16, #17 and #19, it is reasonable to assume that there has been little impact on the validity of the results from the extended hold time.

### Accuracy and Precision

The accuracy of reported values between 20-80% of the calibration maximum is estimated to be  $\pm 10\%$ . This value may be used over the complete calibration range unless otherwise noted in the Problems section of this report. The accuracy decreases and errors increase for lower analyte levels and may be 100% at the instrument detection limit.

### Quality Control

The criterion for the acceptance of data, that the spiked blank value has been quantitated within  $\pm 20\%$ , has been met for both analysis runs. The retention time (R.T.) window for the anion of interest, set as  $\pm 10\%$ , also has been met.

It should be noted that the analyst opted to spike the samples at one-fourth the level that is normally done. The matrix spike and duplicate matrix spike recoveries for sample 92-05953/B01SB4 (SDG #17) was within acceptable limits.

Duplicate sample analyses, performed on sample 92-05953/B01SB4 (SDG #17) was quantitated within the acceptable limit.

### Problems

Except for the lower than normal spiking levels no problems or occurrences of an unusual nature were noted for these samples during this run.

TABLE 5: FREE CYANIDE ANALYSIS FOR TASKS 2 & 4  
SDG #18

																----- % Recovery -----															
Sample ID#	PNL Log#	Sample	C	Sample	C	RPD	---J5---	C	-----J3-----	mg/kg	Control	mg/kg	-----J4-----	mg/kg	Dup. +	mg/kg	-----J6-----	mg/kg	---J3---	Spike	Rec.	---J6---	Dup. +	Spike	Rec.	---J4---	Control	Std.	Rec.	Q	Flags
		J1		dup. J2			Matrix		Sample+		Std.		Standard		Spike		Spike														
B067Y5	92-06428	1.88					5	U			1.25		1.25															100		H	
B01SB4+	92-05953	2.66		2.50		6			4.03	1.26					3.72	1.23	109	86												H	

Concentration Flags [C]

U : [ANALYTE] < IDL  
B : IDL <= [ANALYTE] < CRDL

CRDL = 1.0 mg/kg (solids)  
Estimated IDL = 5 ug/L (liquids), 0.5 mg/kg (solids)

NOTES:

1. + This sample is not part of this SDG but included for QC and documentation purposes.
2. 100% spike level is expected to be 12.50 ug/L in the extract and 1.25 mg/kg in a 0.2 gm sample containing no moisture, see narrative.
3. 100 % extraction efficiency is assumed in defining the extraction dilution as (diluent vol / sample wt) x 1.00 gm/ml .
4. J5 The method blank value has been used in this column. J4 Control Std. is the spiked method blank.
5. The RPD value has been calculated using duplicate results.
6. Samples analyzed 5/14/92

Quality Flags [Q]

H: Hold time not met  
E: Estimated Value  
N: Spike recovery not within control limits  
\*: Duplicate Analysis not within control limits

COMPLEX CYANIDE ANALYSIS RESULTS

The complex cyanide results are calculated from the difference in the total cyanide results and the free cyanide results. A "ferrocyanide" result is not obtained nor calculated since the amount of the complex cyanide being ferrocyanide is indeterminant.

Samples are analyzed for free cyanide based on first determining that the total cyanide result is greater than or equal to 2 mg/Kg for soils or 20  $\mu\text{g/L}$  for water. Soil samples  $<2$  mg/Kg and water samples  $<20$   $\mu\text{g/L}$  total cyanide are typically not analyzed for free cyanide to save on analysis cost. Attempting to perform free cyanide analysis near the Contract Required Detection Limit of total cyanide is not meaningful.

**TABLE 6: COMPLEX CYANIDE DETERMINATION  
FOR TASKS 2 & 4 SDG #18**

Sample ID#	PNL Log#	Total CN mg/Kg	Free CN mg/Kg	Complex CN mg/Kg (1)
B067Y5	92-06428	249	1.9	247

(1) Results calculated by subtracting the free cyanide results from the total cyanide results.



GRAPHITE FURNACE ATOMIC ABSORPTION ANALYSIS RESULTS

Samples for Task 2&4 SDG #18 and the accompanying QC samples were prepared following acid extraction procedure PNL-ALO-101 "Acid Digestion for Metal Analysis". The methodology is consistent with the CLP procedure for acid digestion of waters and sediments. Extracts were analyzed by graphite furnace atomic absorption (GFAA) spectrometry following procedures PNL-ALO-214 (As), PNL-ALO-215 (Se), PNL-ALO-216 (Bi), PNL-ALO-217 (Pb), PNL-ALO-220 (Tl), and PNL-ALO-221 (Ag). The PNL GFAA procedures are comparable to CLP SOW 788 GFAA Methods. Digestion of samples and GFAA analysis were performed in building 325 and analyses were performed on 8/21/92 through 8/31/92. The CLP SOW 788 required hold time of 180 days was met.

The accuracy of the analyses can be estimated from the average of the ICV and CCV percent recoveries, while the analytical precision can be ascertained from the standard deviation of these recoveries.

		<u>Ag</u>	<u>As</u>	<u>Bi</u>	<u>Pb</u>	<u>Se</u>	<u>Tl</u>
ICV/CCV	%Recovery:	106%	105%	103%	106%	107%	105%
	Std. Dev.:	3%	5%	6%	2%	7%	2%

The RPD was omitted in Table 7a for Ag, Se and Tl since the measured concentrations were below the instrument detection limits. The RPD for As and Bi was calculated even though the sample results were below 5x CRDL; the 1 CRDL limit was applied. All samples contained significant quantities of Pb and demonstrated a reasonable RPD of 14%.

Various problems were encountered during the analysis of this SDG group. The problems and issues are addressed on a "per analyte" basis.

\*\*\*\*\* Selenium:

The Se post-digestions spike recoveries were unacceptable on the first set of analyses (8/24/92) and a 10x dilution was performed on the sample and reanalysis was performed (8/25/92 and 8/31/92). The Se results for all samples were below the CRDL and, since the

reanalysis spike recoveries remained very low the Se results were flagged (i.e., "W").

The soil matrix and the presence of Fe may bias Se (and As) results when deuterium background correction is used (as is the case with the PE 5100) rather than Zeeman background correction. The reportable detection limit for Se has been increased by ten-fold due to the necessity of diluting the samples to reduce the matrix interferences responsible for poor analytical spike recoveries.

The initial runs for Se produced negative analytical spike recoveries due to the requirement that the sample results which are less than the IDL be set to zero to calculate the spike recovery. However, by using measured sample and spiked sample absorbances (negative or positive) to calculate the recovery of the spike, all analytical spikes recoveries ranged between 83% to 117%. This provides information to support the contention that the negative absorbances are due to signal suppression caused by a matrix constituent and not due to an analysis or system error.

The middle CCV failed by 1% on the set of 10x diluted samples analyzed on 8/25/92. Since Se was not detectable in any sample, the CCV at 111% is not considered significant and the analyses were not rerun.

There was no detectable Se measured on the pre-digestion spike for soil sample B067Y5 (92-06428); therefore, all samples have been flagged with an "N". A water blank containing the same level of Se spike was recovered at 74% and the LCS (0287 - range 19.1 to 59.4 mg/Kg) was recovered at 33.3 mg/Kg, or 85%. Both of these laboratory controls indicate that there are no problems associated with the sample preparation or GFAA analysis.

## \*\*\*\*\* Arsenic:

The analytical spike for B07Y7 (92-06713-B1) failed at 116%. Since the results for the sample were below the CRDL, no rerun was performed.

## \*\*\*\*\* Silver:

The pre-digestion spikes for both the sample spike 92-06428-B3 and the blank spike control 92-06428-B6 showed no recovery of the silver. The absences of the Ag in the spiked sample may be due to the presence of low concentrations of Cl; however, the loss of the spiked blank control has not been explained, but could be the result of a spiking error. The LCS recovery is good, indicating a good sample preparation operation.



TABLE 7a: GRAPHITE FURNACE AA ANALYSIS DATA FOR TASKS 2 &amp; 4 -- SDG #18

Analyte	Sample ID#	PNL Log#	B1				B2				B1&B2 RPD	B5			B3		B6 (a)		
			Sample mg/Kg	Post Spike Rec	Flags C Q		Dupl. mg/Kg	Post Spike Rec	C	Q		Blank mg/Kg	Post Spike Rec	C	Sample+ Spike mg/Kg	Digest Spike Rec	LCS mg/Kg	LCS Rec	Post Spike Rec
Ag	B067Y5	92-06428	0.11	93%	U	N	0.11	92%	U	N	N/A	0.14	99%	U	0.14	1%	20.21	91%	91%
As	B067Y5	92-06428	3.18	105%			3.38	93%			6%	0.19	102%	U	10.18	88%	886.84	97%	101%
Bi	B067Y5	92-06428	26.34	101%			29.26	105%			10%	0.29	100%	U	36.52	128%	43.78	109%	(b)
Pb	B067Y5	92-06428	15.32	103%			17.64	100%			14%	0.09	96%	U	19.44	103%	266.33	113%	104%
Se	B067Y5	92-06428	0.97	53%	U	NW	1.02	54%	U	NW	N/A	0.13	69%	U	N/A	N/A	33.32	85%	(b)
Tl	B067Y5	92-06428	0.05	93%	U		0.05	94%	U		N/A	0.07	97%	U	8.13	81%	43.66	112%	112%
Ag	B067Y7	92-06713	0.13	97%	U	N													
As	B067Y7	92-06713	1.69	116%	B														
Bi	B067Y7	92-06713	0.84	105%	B														
Pb	B067Y7	92-06713	3.72	90%															
Se	B067Y7	92-06713	1.23	76%	U	NW													
Tl	B067Y7	92-06713	0.06	98%	U														
Ag	B067Z3	92-06726	0.13	96%	U	N													
As	B067Z3	92-06726	2.74	99%															
Bi	B067Z3	92-06726	0.22	105%	U														
Pb	B067Z3	92-06726	3.88	87%															
Se	B067Z3	92-06726	1.22	78%	U	NW													
Tl	B067Z3	92-06726	0.11	99%	B														

The CRDL (IDL) in ug/L: for AA5100 PE (05/18/92) Ag=10 (0.69), As=10 (0.93), Bi=60 (1.44), Pb=3 (0.45), Se=5 (0.63), Tl=10 (0.33)

The CRDL (IDL) in mg/Kg @200X: Ag=2.0 (0.14), As=2.0 (0.18), Bi=12 (0.30), Pb=0.6 (0.09), Se=1.0 (0.13), Tl=2.0 (0.07)

The analytical spike levels in ug/L is 20 for As, Bi, Pb, Tl and 10 for Ag, Se.

LCS standard: Ag, As, Pb, Se, Tl -- ICF 0287; Bi -- Inorganic Ventures G-BI0119

ICV/CCV used during analyses: Ag, Pb, Tl -- ICF ICV4(1290); As, Se -- ICF ICV2(1290); Bi--IV G-BI0119.

Pre-digestion spike (ug/L): Ag=40, As=40, Bi=40, Pb=20, Se=10, Tl=50.

(a) The spiked blank, B6, is used for the Bi control standard; spike is at 40 ug/L. Also, note that B6 for Bi is reported in ug/L.

(b) No analytical spike performed on these samples.

(c) Analysis dates: Ag (8/26/92), As (8/24&31/92), Bi (8/21&31/92), Pb (8/27/92), Se (8/25&31/92), Tl (8/25/92).

CLP Flags: U = [Analyte] < IDL

B = IDL <= [Analyte] < CRDL

N = Pre-digestion Spike Recovery not within control limits (75-125%).

W = Post-digestion spike recovery not within control limits; sample absorbance < 50% of spike absorbance.

\* = RPD not within control limits.

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TABLE 7b: GRAPHITE FURNACE AA ANALYSIS DATA FOR TASKS 2 &amp; 4 -- SDG #18

Analyte	Sample ID#	PNL Log#	-----Bi-----			
			(a) Sample mg/Kg	Post Spike Rec	Flags C Q	
Ag	B067Z5	92-06727	0.14	97%	U	N
As	B067Z5	92-06727	2.32	110%		
Bi	B067Z5	92-06727	1.23	103%	B	
Pb	B067Z5	92-06727	5.12	85%		
Se	B067Z5	92-06727	1.25	71%	U	NW
Tl	B067Z5	92-06727	0.07	102%	U	
Ag	B06809	92-06904	0.13	99%	U	N
As	B06809	92-06904	2.10	102%		
Bi	B06809	92-06904	0.69	91%	B	
Pb	B06809	92-06904	2.44	89%		
Se	B06809	92-06904	1.19	79%	U	NW
Tl	B06809	92-06904	0.06	99%	U	

The CRDL (IDL) in ug/L: for AA5100 PE (05/18/92) Ag=10 (0.69), As=10 (0.93), Bi=60 (1.44), Pb=3 (0.45), Se=5 (0.63), Tl=10 (0.33)  
 The CRDL (IDL) in mg/Kg @200X: Ag=2.0 (0.14), As=2.0 (0.18), Bi=12 (0.30), Pb=0.6 (0.09), Se=1.0 (0.13), Tl=2.0 (0.07)

The analytical spike levels in ug/L is 20 for As, Bi, Pb, Tl and 10 for Ag, Se.

(a) Supporting QC (e.g., LCS, duplicates, pre-digestion spikes) shown in Table 7a.

(d) Analysis dates: Ag (8/26/92), As (8/24&31/92), Bi (8/21&31/92), Pb (8/27/92), Se (8/25&31/92), Tl (8/25/92).

CLP Flags: U = [Analyte] < IDL

B = IDL <= [Analyte] < CRDL

W = Post-digestion spike recovery not within control limits; sample absorbance < 50% of spike absorbance.

\* = RPD for batch duplicate not within control limits.

N = Pre-digestion Spike Recovery not within control limits (75-125%).

MERCURY COLD VAPOR ATOMIC ABSORPTION ANALYSIS RESULTS

Samples for Task 2&4 SDG #18 and their accompanying QC samples were analyzed by cold vapor atomic absorption (CVAA) spectrometry following procedure PNL-ALO-213 (Mercury in Water, Solids, and Sludges by Manual Cold Vapor Technique). The PNL manual CVAA procedure is consistent with CLP SOW 788 CVAA Method. Digestion of samples and CVAA Hg analysis were performed in the 325 building, laboratory 313. The CLP SOW 788 and contract required hold time of 26 days was met for all samples.

Due to difficulties in obtaining consistent acceptance of the ICV/CCV analysis and also in meeting the recovery requirements of the LCS, minor modifications of the procedure have been documented (DR-91-99) and implemented. These modifications, which were primarily changes in the reaction chamber design and path length reductions, improve the detection limit by 10x and significantly improve reproducibility at the concentration levels required by the contract. These modifications have been incorporated into a new revision of the Hg procedure which is currently undergoing technical review.

The CVAA Hg analyses were conducted on a Perkin-Elmer 5000 AA instrument. The results for the samples are reported in Table 8, along with the QC spike and duplicate from B067Y5 (for analyses performed on 5/1/92) and B06809 (for analyses performed on 5/21/92) and LCS recoveries.

For the 5/1/92 Hg analysis batch the average recovery for the two ICV/CCV analyses was 100%; for the 5/21/92 Hg analysis batch the average recovery for three ICV/CCV analyses was 98.6% with a standard deviation of 2.4%. The analysis of the LSC (0287) sample on 5/1/92 and 5/21/92 was 11.9 and 9.6 mg/kg, respectively; both LCS analyses being within the 8.5-17.0 certified range. The pre-digestion spike recovery for both batches was 101%. Precision, as indicated by the RPD from two sets of sample and duplicate analyses, was approximately 10%.

TABLE 8: Hg COLD VAPOR AA ANALYSIS DATA  
SDG #18

SOLID SAMPLES

		B1		B2		B5		B3 (a)		B4 (b)		
Sample ID#	PNL Log#	Sample mg/Kg	Flags C Q	Dupl. mg/Kg	C	B1&B2 %RPD	Blank mg/Kg	C	Sample +Spike mg/Kg	Digest Spike %rec	LCS mg/Kg	LCS %rec
Date: 05/01/92												
B067Y5	92-06428	0.06		0.07		4%	0.004	B	0.27	101%	11.86	93%
B067Y7	92-06713	0.06										
B067Z3	92-06726	0.03										
B067Z5	92-06727	0.18										
	SRM 2704										1.41	96%
Date: 05/21/92												
B06809	92-06904	0.03		0.04		11%	0.004	U	0.24	101%	9.56	75%
	SRM 2704										1.30	89%

- (a) B3 Predigestion Spike = 0.05 ug Hg in 25 mL aliquot. (Analysis aliquot: sample 25mL, spike 10mL)  
 (b) LCS 0287 Hg certified at 12.7 mg/Kg (Range 8.5 to 17.0 mg/Kg)  
 (c) If analyzed, NIST SRM2704 certified at 1.47 ug/g Hg  
 (d) RPD only calculated if both sample and duplicate are >IDL  
 (e) IDL = 0.04 ug/L [or 0.004 mg/Kg -- (0.04ug/L \* 0.1L) / 1g]  
 (f) CRDL = 0.2 ug/L [or 0.02 mg/Kg -- (0.2 ug/L \* 0.1L) / 1g]  
 (g) Calibration standards NIST SRM3133, ICV/CCV standard Johnson-Matthey 14395

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INDUCTIVELY COUPLED PLASMA ATOMIC EMISSION SPECTROPHOTOMETRIC ANALYSIS RESULTS

Samples and their accompanying quality control samples were prepared following acid digestion by procedure PNL-ALO-101, Acid Digestion for Metal Analysis. The methodology is consistent with the CLP procedure for the acid digestion of waters and sediments. The acid leachates were then analyzed by Inductively Coupled Plasma Atomic Emission Spectrophotometry (ICP-AES) following procedure PNL-ALO-211. This method is comparable to EPA method 200.7 CLP-M. Calibration standard sources and preparation information are located in the PNL-ALO instrument archive file: "ICP-325-405". The analysis was performed in the ICP lab 405, building 325 in the 300 area.

The data is presented following U.S. EPA - CLP reporting format according to the SOW 7/88 protocol. Analyte concentrations are reported as dry weight corrected concentrations on "FORM I - IN, INORGANIC ANALYSES DATA SHEET". Spike sample recoveries are reported on "FORM V (Part 1) - IN, SPIKE SAMPLE RECOVERY". Duplicates and RPD's (Relative Percent Differences) are reported on "FORM VI - IN, DUPLICATES". Laboratory quality control sample results are reported on "FORM VII - IN, LABORATORY CONTROL SAMPLE".

This discussion is relative to the following samples (ALO Log-In #'s) in SDG# 18: 92-06428, 92-06713, 92-06726, 92-06727, 92-06904.

The quarterly linear range test lapsed the normal time span (3 months) by three days. This test is intended to demonstrate validity of linearity up to some maximum value, usually the concentration value of the high calibration standard. Linearity can also be demonstrated based upon the measurements of the interference check standard, although the standard is not specifically intended for this purpose. The quality control check standard contain analytes at very high concentrations, generally much higher than that found in most soil samples. Since the results of the interference check standard measurements were all within acceptable limits and represent concentrations higher than those normally found in soil samples, this measurement provides evidence that any measurement at or below this concentration would be linear.



All of the analyte concentrations in the soil samples measured within SDG #18 were much less than the concentrations found in the interference check standard. Therefore the time laps of the quarterly linear range test should have no effect upon the accuracy of the measurements reported.

This report contains the results for all of the samples including a pre-digestion spiked sample and a post-digestion spiked sample for antimony recovery test. The pre-digestion spiked sample failed to meet the recovery limits for antimony, manganese, and nickel. Because antimony has routinely failed the pre-digestion spike recovery test on 200BP1 soil samples, a "post-digestion" spiked sample was prepared and analyzed. The post-digestion spiked sample result for antimony was within acceptance limits similar to past analyses. This is the sixth group of samples that have had a pre-digestion spike recovery test fail for the analyte antimony. Although techniques are known that would keep antimony soluble, they can not be used since it would be in conflict with the digestion preparation method defined by CLP SOW 7/88.

Precision and accuracy for the quality control samples were within EPA acceptance limits with the following exceptions: low aluminum recovery from the laboratory control sample (LCS-0287); under recovery for nickel and antimony and over recovery for manganese in the pre-digestion spike sample; poor duplicate sample precision (48%) for copper; and failure of the serial dilution test. Failure of the serial dilution test was due to a mechanical dilution error. This appears to be demonstrated by the fact that the majority of analytes that have concentrations significantly above the IDL were all similar but low by approximately 15% difference from the "initial sample result". Previous serial dilution tests have not demonstrated difficulties toward meeting the  $\pm 10\%$  acceptance criteria. Therefore failure of the serial dilution test most likely does not reflect any "matrix" problems relative to the soils samples being measured.

The reason for the low recovery for aluminum in the laboratory control standard (LCS-0287) is not known. Calibration verification standards were well within the 90% to 110% control limits. The aluminum concentration in the (LCS-0287) is very low (approximately 300 mg/Kg) compared to the concentration of



aluminum found in the samples (5000 to 10,000 mg/Kg). There should be minimal effect on the aluminum results.

The over recovery for manganese and the under recovery for nickel in the pre-digestion spiked sample (B067Y5 "S") is probably attributed to sample in-homogeneity. Manganese in the un-spiked sample "B067Y5" (221 mg/Kg) is low relative to the other soil samples (227 to 310 mg/Kg). This might account for the over recovery (156.5%) of manganese. Nickel recovery was low in the pre-digestion spike sample (57.5%). The nickel concentration in the un-spiked sample (B067Y5) was nearly ten times (131 mg/Kg) higher than any of the other samples analyzed during this run, with a single exception of 65.8 mg/Kg (B06825 from SDG #19). The remaining eight samples ranged between 8.3 and 14.6 mg/Kg in nickel concentration. The poor duplicate precision for copper is also most likely caused by sample in-homogeneity, especially at the low concentration found in the samples (13.3 and 8.1 mg/Kg). With exception of the two anomalous high nickel values (131 and 65.8 mg/Kg) and the single low manganese value noted above, the majority of the values for nickel, manganese, and copper are below average soil concentrations of 40, 850, and 20 mg/Kg respectively (RR Brooks, Geobotany & Biogeochemistry in Mineral Exploration, 1972). Therefore the consequence of the unacceptable pre-digestion spike sample recovery for manganese and nickel should not significantly impact this report.

The fundamental problem of achieving acceptable analytic precision for spike sample recovery and relative percent difference between duplicates is directly correlated with sample homogeneity. It was virtually impossible to withdraw a "representative" sub-sample for ICP cation analyses from any of the soil samples received. Nearly all of the samples contained large rock fragments (up to 10 mm in cross section at times) mixed in with varying finer gradations of rock, down to silt and clay size fractions. Normally, one would sieve the samples to obtain a 1 mm diameter and smaller size fraction. If a analysis of the total content of the sample is needed, the next step in preparing the sample would be to grind it to less than 63 micron size particles. If an acid leach of the surface coatings only are needed, the

grinding step would be by-passed. Sample sieving during soil sample preparation was not permitted under the conditions of the present contract.

Another contributing factor which may lead to anomalous values comes from the hydrous-oxide coatings observed on rock fragments in the samples. Analytes such as zinc and manganese often are enriched in these coatings. The acid leach procedure used in sample preparation in this contract would easily solubilize these coatings. Inclusion of either large rock fragments or excessive amounts of hydrous-oxide crust would bias the concentrations either lower or higher for some analytes. Thus the process of preparing or not preparing the sample properly before sub-sampling can alter the analytic measurements. If not properly prepared it can lead to large variations in pre-digestion spike recoveries and poor precision between "duplicate" samples. These effects were observed for most of the soil samples measured.



## U.S. EPA - CLP

## COVER PAGE - INORGANIC ANALYSES DATA PACKAGE

Lab Name: BATTELLE\_PNL \_\_\_\_\_ Contract: \_\_\_\_\_  
 Lab Code: \_\_\_\_\_ Case No.: \_\_\_\_\_ SAS No.: \_\_\_\_\_ SDG No.: 18&19\_  
 SOW No.: 7/88\_

EPA Sample No.	Lab Sample ID
B067Y5	92-6428-B1
B067Y5 D	92-6428-B2
B067Y5 L	92-6428-BL
B067Y5 S	92-6428-B3
B067Y7	92-6713-B1
B067Z3	92-6726-B1
B067Z5	92-6727-B1
B06809	92-6904-B1
B06813	92-6963-B1
B06815	92-6964-B1
B06823	92-7040-B1
B06825	92-7141-B1
B06827	92-7142-B1

Were ICP interelement corrections applied ? Yes/No YES  
 Were ICP background corrections applied ? Yes/No NO\_  
 If yes - were raw data generated before  
 application of background corrections ? Yes/No

## Comments:

200BP1 TASK 2 & 4, SDG# 18 & 19  
 ANALYST: ML THOMAS  
 DATE ANALYZED: 06/30/92 (ARCHIVE FILE: ICP-325-405) 92D182A  
 INSTRUMENT M&TE: WB73520

I certify that this data package is in compliance with the terms and conditions of the contract, both technically and for completeness, for other than the conditions detailed above. Release of the data contained in this hardcopy data package and in the computer-readable data submitted on floppy diskette has been authorized by the Laboratory Manager or the Manager's designee, as verified by the following signature.

Signature: \_\_\_\_\_ Name: \_\_\_\_\_  
 Date: \_\_\_\_\_ Title: \_\_\_\_\_

COVER PAGE - IN

3/90

## U.S. EPA - CLP

1  
INORGANIC ANALYSES DATA SHEET

EPA SAMPLE NO.

B067Y5

Lab Name: BATTELLE\_PNL Contract: BATTELLE\_P

Lab Code: Case No.: SAS No.: SDG No.: 18&amp;19

Matrix (soil/water): SOIL Lab Sample ID: 92-6428-B1

Level (low/med): LOW Date Received: 04/21/92

% Solids: 96.8

Concentration Units (ug/L or mg/kg dry weight): MG/KG

CAS No.	Analyte	Concentration	C	Q	M
7429-90-5	Aluminum	5210	-	E	P
7440-36-0	Antimony	3.0	U	N	P
7440-39-3	Barium	74.8	-	E	P
7440-41-7	Beryllium	0.22	B	-	P
7440-43-9	Cadmium	0.93	B	-	P
7440-70-2	Calcium	6530	-	E	P
7440-47-3	Chromium	11.2	-	-	P
7440-48-4	Cobalt	3.9	B	-	P
7440-50-8	Copper	13.3	-	*	P
7439-89-6	Iron	13600	-	E	P
7439-95-4	Magnesium	4080	-	E	P
7439-96-5	Manganese	221	-	EN	P
7440-02-0	Nickel	131	-	EN	P
7440-09-7	Potassium	499	B	-	P
7440-23-5	Sodium	1340	-	E	P
7440-62-2	Vanadium	22.5	-	E	P
7440-66-6	Zinc	29.0	-	E	P

Color Before: Clarity Before: Texture:

Color After: Clarity After: Artifacts:

## Comments:

DATE PREPARED: 06/22/92 (D ORTIZ)

DATE ANALYZED: 06/30/92 (LM THOMAS)



## U.S. EPA - CLP

1  
INORGANIC ANALYSES DATA SHEET

EPA SAMPLE NO.

B067Y7

Lab Name: BATTELLE\_PNL \_\_\_\_\_ Contract: BATTELLE\_P

Lab Code: \_\_\_\_\_ Case No.: \_\_\_\_\_ SAS No.: \_\_\_\_\_ SDG No.: 18&amp;19\_

Matrix (soil/water): SOIL\_ Lab Sample ID: 92-6713-B1

Level (low/med): LOW\_ Date Received: 04/21/92

% Solids: \_97.5

Concentration Units (ug/L or mg/kg dry weight): MG/KG

CAS No.	Analyte	Concentration	C	Q	M
7429-90-5	Aluminum	6470	—	E	P
7440-36-0	Antimony	2.1	U	N	P
7440-39-3	Barium	60.3	—	E	P
7440-41-7	Beryllium	0.29	B	—	P
7440-43-9	Cadmium	0.58	B	—	P
7440-70-2	Calcium	9550	—	E	P
7440-47-3	Chromium	9.4	—	—	P
7440-48-4	Cobalt	5.5	B	—	P
7440-50-8	Copper	16.4	—	*	P
7439-89-6	Iron	16500	—	E	P
7439-95-4	Magnesium	4510	—	E	P
7439-96-5	Manganese	278	—	EN	P
7440-02-0	Nickel	8.3	—	EN	P
7440-09-7	Potassium	610	B	—	P
7440-23-5	Sodium	1730	—	E	P
7440-62-2	Vanadium	33.4	—	E	P
7440-66-6	Zinc	33.6	—	E	P

Color Before: \_\_\_\_\_ Clarity Before: \_\_\_\_\_ Texture: \_\_\_\_\_

Color After: \_\_\_\_\_ Clarity After: \_\_\_\_\_ Artifacts: \_\_\_\_\_

## Comments:

DATE PREPARED: 06/22/92 (D ORTIZ)

DATE ANALYZED: 06/30/92 (LM THOMAS)



## U.S. EPA - CLP

1  
INORGANIC ANALYSES DATA SHEET

EPA SAMPLE NO.

B06723

Lab Name: BATTELLE\_PNL Contract: BATTELLE\_P

Lab Code: Case No.: SAS No.: SDG No.: 18&amp;19

Matrix (soil/water): SOIL Lab Sample ID: 92-6726-B1

Level (low/med): LOW Date Received: 04/21/92

% Solids: 96.6

Concentration Units (ug/L or mg/kg dry weight): MG/KG

CAS No.	Analyte	Concentration	C	Q	M
7429-90-5	Aluminum	8470	-	E	P
7440-36-0	Antimony	3.0	U	N	P
7440-39-3	Barium	74.4	-	E	P
7440-41-7	Beryllium	0.38	B	-	P
7440-43-9	Cadmium	0.80	B	-	P
7440-70-2	Calcium	7290	-	E	P
7440-47-3	Chromium	14.1	-	-	P
7440-48-4	Cobalt	5.5	B	-	P
7440-50-8	Copper	15.4	-	*	P
7439-89-6	Iron	17100	-	E	P
7439-95-4	Magnesium	5050	-	E	P
7439-96-5	Manganese	294	-	EN	P
7440-02-0	Nickel	10.8	-	EN	P
7440-09-7	Potassium	1470	-	-	P
7440-23-5	Sodium	5800	-	E	P
7440-62-2	Vanadium	34.0	-	E	P
7440-66-6	Zinc	34.8	-	E	P
			-	-	-
			-	-	-
			-	-	-
			-	-	-
			-	-	-
			-	-	-
			-	-	-
			-	-	-
			-	-	-

Color Before: Clarity Before: Texture:

Color After: Clarity After: Artifacts:

## Comments:

DATE PREPARED: 06/22/92 (D ORTIZ)

DATE ANALYZED: 06/30/92 (LM THOMAS)

## U.S. EPA - CLP

1  
INORGANIC ANALYSES DATA SHEET

EPA SAMPLE NO.

B067Z5

Lab Name: BATTELLE\_PNL Contract: BATTELLE\_P

Lab Code: Case No.: SAS No.: SDG No.: 18&amp;19\_

Matrix (soil/water): SOIL\_ Lab Sample ID: 92-6727-B1

Level (low/med): LOW\_ Date Received: 04/21/92

% Solids: 97.8

Concentration Units (ug/L or mg/kg dry weight): MG/KG

CAS No.	Analyte	Concentration	C	Q	M
7429-90-5	Aluminum	10300	-	E	P
7440-36-0	Antimony	3.0	U	N	P
7440-39-3	Barium	71.5	-	E	P
7440-41-7	Beryllium	0.34	B	-	P
7440-43-9	Cadmium	0.61	B	-	P
7440-70-2	Calcium	7680	-	E	P
7440-47-3	Chromium	11.7	-	-	P
7440-48-4	Cobalt	7.5	B	-	P
7440-50-8	Copper	16.7	-	*	P
7439-89-6	Iron	19700	-	E	P
7439-95-4	Magnesium	4460	-	E	P
7439-96-5	Manganese	279	-	EN	P
7440-02-0	Nickel	14.6	-	EN	P
7440-09-7	Potassium	855	B	-	P
7440-23-5	Sodium	6010	-	E	P
7440-62-2	Vanadium	46.5	-	E	P
7440-66-6	Zinc	36.8	-	E	P

Color Before: Clarity Before: Texture:

Color After: Clarity After: Artifacts:

## Comments:

DATE PREPARED: 06/22/92 (D ORTIZ)

DATE ANALYZED: 06/30/92 (LM THOMAS)



## U.S. EPA - CLP

1  
INORGANIC ANALYSES DATA SHEET

EPA SAMPLE NO.

B06809

Lab Name: BATTELLE\_PNL Contract: BATTELLE\_P

Lab Code: Case No.: SAS No.: SDG No.: 18&amp;19\_

Matrix (soil/water): SOIL\_ Lab Sample ID: 92-6904-B1

Level (low/med): LOW\_ Date Received: 04/21/92

% Solids: 97.8

Concentration Units (ug/L or mg/kg dry weight): MG/KG

CAS No.	Analyte	Concentration	C	Q	M
7429-90-5	Aluminum	6500	-	E	P
7440-36-0	Antimony	2.8	U	N	P
7440-39-3	Barium	80.5	-	E	P
7440-41-7	Beryllium	0.33	B	-	P
7440-43-9	Cadmium	0.50	B	-	P
7440-70-2	Calcium	6390	-	E	P
7440-47-3	Chromium	12.6	-	-	P
7440-48-4	Cobalt	7.3	B	-	P
7440-50-8	Copper	18.6	-	*	P
7439-89-6	Iron	20600	-	E	P
7439-95-4	Magnesium	3930	-	E	P
7439-96-5	Manganese	246	-	EN	P
7440-02-0	Nickel	10.3	-	EN	P
7440-09-7	Potassium	550	B	-	P
7440-23-5	Sodium	1840	-	E	P
7440-62-2	Vanadium	50.4	-	E	P
7440-66-6	Zinc	34.2	-	E	P

Color Before: Clarity Before: Texture:

Color After: Clarity After: Artifacts:

## Comments:

DATE PREPARED: 06/22/92 (D ORTIZ)

DATE ANALYZED: 06/30/92 (LM THOMAS)



ICP/MS ANALYSIS RESULTS

Samples in this SDG were not analyzed for Tc-99 and U concentrations as radioactive dose levels of leachate solutions were above instrument allowable radioactivity limits. Leachate solutions were not diluted to allowable limits as the resulting IDL would, most probably, exceed the concentration of analytes of interest in the samples. Samples were analyzed at a later date by alternate methods and/or instruments and will follow in a separate report.

TABLE 9: ICP-MS Analysis Data

No data available at this time.

9713508.1815

FROM THE DESK OF:

PAT REICH  
SAMPLE MANAGEMENT  
(509) 372-2785/H4-14

5-23-96<sup>MC</sup>  
B067Y5-PNL-066  
TO: ~~B01SH7-PNL-068~~

DATE: March 29, 1995

5-23-96<sup>MC</sup>  
B067Y5-PNL-066  
SUBJECT: TC-99 AND URANIUM DATA FOR ~~B01SH7-PNL-068~~

5-23-96<sup>MC</sup>  
Due to Lab sample batching the Tc-99 and Uranium analysis with the complete raw data requested for this data package is filed in ~~B015P1-PNL-069~~. B015P0-PNL-055

Attached is a copy of the PNL Summary and Cover letter with the sample results included.

Thank You,

Pat Reich  
Sample Management

Tc-99 + U are filed in B015P0-PNL-055  
for packages B015ND-PNL-061, B015Q4-  
PNL-056, B015P0-PNL-055, B01592-  
PNL-063, B015C7-PNL-064, B01SH7-PNL-  
068, B067Y5-PNL-066, B06B13-PNL-067.

J.M. Duncan  
5/23/96

D. F. Ayres  
5/23/96



COPY

**Battelle**

Pacific Northwest Laboratories  
P.O. Box 999  
Richland, Washington U.S.A. 99352  
Telephone (509)

Telex 15-2874

376-5802

October 14, 1992



Ms. J. M. Duncan, T6-08  
Westinghouse Hanford Company  
P.O. Box 1970  
Richland, Washington 99352

Dear Ms. Duncan:

TRANSMITTAL OF 200-BP-1 SITE INVESTIGATION ANALYTICAL CHEMISTRY SUPPORT PROJECT, TASKS 2 AND 4, ICP-MS Tc-99 AND URANIUM DATA PACKAGE/REPORT FOR NOS. 12-19, REVISION 0, OCTOBER 14, 1992

(Ref: Letter to J. A. Lerch, "Transmittal of Interim Change Notice for Pacific Northwest Laboratory (PNL) Analytical Procedure for the 200-BP-1 Site Investigation Analytical Chemistry Support Project." dated April 1, 1992.)

Enclosed are two copies of the report and one copy of the appendices of the subject 200-BP-1 Tasks 2 and 4, ICP-MS Tc-99 and Uranium Data Package/Report for SDG Nos. 12-19, Revision 0, October 14, 1992 and a PNL Analytical Chemistry Laboratory Data Report/Package Acknowledgement Form for the data report/package. Please sign the form and return to me as agreed upon in the reference above.

Also, a reminder, PNL is to be notified of validation of all data report/packages as defined in the "Memorandum of Understanding Between the Pacific Northwest Laboratory (PNL) and Westinghouse Hanford Company (WHC) on 325 Laboratory Operations in Support of Hanford Site Tank Waste Characterization Activities, March 10, 1992."

If you have any questions about the above or after reviewing the data, please give me a call on 376-5802.

Sincerely,

B. M. Gillespie  
200-BP-1 PNL Project Manager  
Analytical Laboratory Operations

Enclosures

**200-BP-1 SITE INVESTIGATION  
ANALYTICAL CHEMISTRY SUPPORT PROJECT**

**TASKS 2 & 4**

**ICP-MS Tc-99 and Uranium**

**DATA PACKAGE/REPORT for SDG NOs. 12-19**

**Revision 0**

**RECORD COPY**

**October 14, 1992**

**Prepared by: B.M. Gillespie**



**Pacific Northwest Laboratory**

**(PNL Project #16772)**

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CONTRIBUTORS LIST

PROJECT MANAGEMENT OFFICE

BM Gillespie, Project Manager  
TL Ehlert, Quality Engineer  
RM Nipper, Project Assistant  
JL Reilly, Senior Clerk  
SL Humphreys, Senior Clerk

QUALITY CONTROL OFFICERS

KJ Kuhl-Klinger

RADIOCHEMISTRY ANALYSIS

DW Koppenaal, Sub Task Leader  
JP Bramson  
MW Goheen  
EJ Wyse

HOT CELL ANALYSIS

RT Steele  
FV Hoopes  
JK Rau



INTRODUCTION

This data package contains the results obtained by Pacific Northwest Laboratory (PNL) staff in the characterization of samples for the 200-BP-1 Site Investigation Analytical Chemistry Support Project. The samples were submitted for analysis by Westinghouse Hanford Company (WHC) under the Technical Project Plan (TPP) 16772 and the Quality Assurance Project Plan (QAPjP) ALO-001. The analytical procedures required for analysis were defined in the Test Instructions (TI) prepared by the PNL 200-BP-1 Project Management Office in accordance with the TPP and the QAPjP ALO-001.

The samples (Table 1) were submitted with the appropriate WHC Chain of Custody (COC) and Sample Analysis Request Forms. The samples were delivered to the 300 Area, 325 building 200-BP-1 Sample Custodian.

The analyses requested for the samples in this report are technetium-99 and uranium. The quality control (QC) requirements for the samples are defined in the test instructions for each sample. The QC requirements outlined in the procedures and requested in the WHC SOW were followed. Method blanks, matrix spikes, sample duplicates and/or matrix spike duplicates were analyzed. All QC data that exist are included in this Data Package/Report.

Three appendices are provided; one for Test Instruction, one for Chain of Custody, Sample Analysis Request Forms and Sample Receipt Forms and one that contains the primary ICP-MS analytical data.

CERTIFICATION STATEMENT

I certify that this data package is in compliance with the terms and conditions of the TPP 16772 and QAPjP ALO-001 for completeness. Release of the data contained in this hard copy data package and in the computer-readable data submitted on floppy diskette has been authorized by the Project Manager or the Project Manager's designee, as verified by the following signature.

B. M. Gillespie  
B. M. Gillespie  
200-BP-1 Project Manager

10/14/92  
Date

## 200-BP-1 TASKS 2 AND 4 ICP-MS HOT SAMPLE ANALYSES

## DATA PACKAGE TASK 2&amp;4, #12

-----  
B015P1 92-02332  
B015P5 92-02628  
B015P9 92-02629  
B015Q1 92-02630

## DATA PACKAGE TASK 2&amp;4, #13

-----  
B015R5 92-03236  
B015S1 92-03300

## DATA PACKAGE TASK 2&amp;4, #14

-----  
B01S75 92-03738  
B01S77 92-039C1  
B01S89 92-03902

## DATA PACKAGE TASK 2&amp;4, #15

-----  
B01S97 92-04734  
B01S99 92-04735  
B01SB1 92-04736  
B01SB3 92-04968  
B01SB7 92-05102  
B01SB2 92-05150

## DATA PACKAGE TASK 2&amp;4, #16

-----  
B01SC7 92-05270  
B01SC9 92-05271  
B01SD9 92-05352  
B01SD7 92-05353  
B01SF7 92-05490  
B01SF9 92-05491  
B01SG3 92-05492  
B01SG7 92-05633  
B01SG9 92-05634  
B01SH3 92-05690

## DATA PACKAGE TASK 2&amp;4, #17

-----  
B01SH7 92-05877  
B01SB4 92-05953  
B01SC8 92-05954



200-BP-1 TASKS 2 AND 4 ICP-MS HOT SAMPLE ANALYSES  
(continued)DATA PACKAGE TASK 2&4, #18  
-----

B067Y5	92-06428
B067Y7	92-06713
B067Z3	92-06726
B067Z5	92-06727
B06809	92-06904

DATA PACKAGE TASK 2&4, #19  
-----

B06813	92-06963
B06815	92-06964
B06823	92-07040
B06825	92-07141
B06827	92-07142

## **RADIOCHEMICAL DATA TABLES**

ICP/MS ANALYSIS RESULTS

The project samples and accompanying QC were prepared for ICP/MS analysis using procedure PNL-ALO-101, Acid Digestion for Metal Analysis. This methodology is consistent with CLP Inorganics acid digestion for metals. The resulting digestates were further diluted and analyzed by inductively coupled plasma mass spectrometry (ICP/MS) according to procedure PNL-ALO-280, Inductively Coupled Plasma Mass Spectrometric (ICP/MS) Analysis. Technetium was determined using procedure PNL-ALO-281 (ICP/MS Determination of  $^{99}\text{Tc}$ ), and uranium was determined using procedure PNL-ALO-282 (Determination of Uranium Concentration / Isotopic Composition Using ICP/MS). The calibration standard concentrations for these analyses are documented in the raw data. Samples were prepared in the 325 building and the  $^{99}\text{Tc}$  and U determinations were performed on the shielded ICP/MS unit in room 115 of building 3708 in the 300 area. A total of five analytical runs were necessary to include all regular and QC samples. The fifth analysis was performed for samples requiring a reanalysis. Criteria for a reanalysis included memory effects, concentrations outside calibration range, or general inconsistencies.

Previous ICP/MS analyses for 200-BP-1 samples involved the use of an ultrasonic nebulizer (USN) to maximize instrument sensitivity. Unfortunately, a USN for radioactive use has not yet been acquired, so the samples were aspirated using a conventional pneumatic nebulizer. While the extra sensitivity may have been beneficial for determining the technetium concentration, it would have had a negative impact on the uranium analysis. In fact, it is almost certain that the use of a USN would have resulted in additional dilutions to obtain the uranium concentration in many of the samples. As it was, all samples were analyzed for Tc at an additional dilution of only 2X to mitigate matrix effects.

Results were calculated using PQ software as outlined in PNL-ALO-280 and the operations manuals. Additional calculations can be necessary, however, to correct for interferences with elements of interest. At mass 99, technetium is interfered by an isotope of ruthenium; a correction is therefore necessary to subtract out the isobaric ruthenium contribution. To be accurate, this



correction factor assumes natural ruthenium isotopic abundance. There are indications that the apparent Ru in these samples is not of natural isotopic abundance; this is not surprising considering the likely source of this ruthenium. It appears that this ruthenium does not contain a measurable isotope at mass 99. For this reason, correction factors for ruthenium were obtained but were not applied in calculating the technetium concentrations. (These factors are reported in the data table however for information and for the sake of completeness.) Judging from the spiked sample recovery values, the decision not to factor in the possible Ru contribution appears to be legitimate. Some samples were calculated as containing small but measurable quantities of technetium, however the corresponding spectrum did not indicate a positive identifiable peak; these results are reported but parenthesized to indicate qualitative uncertainty.

As specified in ALO-280, appropriate internal standards were used to correct for instrument drift and general signal suppression. The elements chosen were indium (for technetium), thorium and thallium (for uranium). Indium is commonly used as an internal standard due to its absence in all but very few samples. There is more difficulty in choosing an appropriate internal standard for the high masses; there aren't that many of them above mass 200, and those that exist may be present in soils. For this reason, two elements were chosen to represent the high mass response. Unfortunately, the results indicate that many of the samples contain at least one of these elements in measurable concentrations. This was not a problem in 4 of the 5 runs, because indium served as a legitimate substitute; for one run (2922a) however, only uranium was being analyzed and indium was not scanned. To obtain legitimate results for this run, the uranium concentration for all runs was calculated against each internal standard, and the results calculated against Th and Tl were compared with those calculated against In. A thorough analysis of the data indicates that the results calculated against Tl most closely resembled the In results. It appeared that there was a small but measurable quantity of Th in many of the samples (indicated by 10-20% lower uranium concentrations relative to those obtained against In and Tl), and the few samples that contained Tl contained it in significant quantities (indicated by dramatically lower uranium concentrations relative to those

obtained against In and Th). Simply put, the presence of thallium was obvious when reviewing the raw data but the presence of Th was not. Therefore the results obtained on 2922a were calculated using Tl as the internal standard unless Tl was present in the sample. The three samples that contained Tl were calculated using Th as the internal standard.

Quality control measures included the analysis of check standards, sample duplicates, and spiked samples. Technetium matrix spike recoveries show good agreement with true values, but the uranium concentration in the samples is again far greater than the amount spiked, thereby invalidating the spiked sample recovery. Additionally, the blank spike uranium recovery for sample 2628-B6 was negatively affected by a relatively high blank concentration; this is not believed to be significant, however, considering the significantly higher uranium concentration observed in the samples. The uranium recovery for 5633-B6 is acceptable if the uncertainty of the value is considered. Recovery for Tc and U was calculated using the following formula:

Matrix Spike recovery (%) =  $100 * ([\text{Spiked Sample}] - [\text{Sample}]) / [\text{Spike}]$

Blank Spike recovery (%) =  $100 * ([\text{Spiked Blank}] - [\text{Blank}]) / [\text{Spike}]$

Unless otherwise specified, the uncertainty of the values reported is estimated at  $\pm 10\%$ , and is based on known versus found check standard results, results between duplicate samples, and deviations between analytical runs. Data in parentheses should be considered suspect.



# 200-BP-1 HOT SOIL ANALYSIS

## Tc-99 and Uranium determinations

Sep. 30, 1992

PNL Sample I.D. # (a)	Digest. Dil. Factor (b)	ICP/MS Analysis No.	Analysis Dilution Factor (c)	[Tc-99] ng/ml leachate (d)	[Tc-99] ng/g soil (e,f)	Ru Correcin Factor (g)	[Tc-99] ng/g spiked (f)	[Tc-99] spike yield, % (h)	[Tc-99] pCi/g, dry soil	ICP/MS Analysis No.	Analysis Dilution Factor (c)	[U] ng/ml leachate (d)	[U] µg/g soil (e,f)	[U] µg/g spiked (f)	[U] spike yield, % (h, i)	[U] pCi/g, dry soil (j)
2332 - B1	180.5	2925a32	2x	<0.02	<4				<70	2925a32	2x	148	26.7			18.7
2628 - B1	175.5	2925a38	2x	0.03	5				(90)	2925a38	2x	288	50.5			35.3
2628 - B2	179.8	2925a37	2x	0.04	8				(100)	2925a37	2x	284	51.0			35.6
2628 - B3	172.7	2925a36	2x	0.12	21	0.160	17	90%	380	2925a36	2x	329	56.8	0.173	3039%	39.7
2628 - B5	200.0	2925a35	2x	<0.02	<4				<70	2925a35	2x	2±8	0.412			0.3±2
2628 - B6	200.0	2925a33	2x	0.12	24	0.884	20	120%	410	2925a33	2x	1±4	0.2±0.8	0.200	-88%	0.1±0.5
2629 - B1	193.5	2928a17	2x	0.02	5				(80)	2928a17	2x	228	44.1			30.8
2630 - B1	183.8	2925a24	2x	<0.02	<4				<70	2925a24	2x	34.4	8.32			4.41
3236 - B1	197.8	2925a28	2x	0.03	5				(90)	2925a28	2x	43.0	8.50			5.94
3237 - B1	162.0	2921a31	2x	0.04	8				(100)	2922a30	2x	80.0	13.0			9.05
3300 - B1	176.0	2928a19	2x	0.02	4	0.734			60	2928a19	2x	2.51	0.44			0.31
3738 - B1	184.5	2921a19	2x	0.03	6				(100)	2922a29	2x	221	40.8			28.5
3901 - B1	191.7	2921a17	2x	<0.02	<4				<70	2922a27	5x	407	78.0			54.5
3901 - B2	196.7	2925a20	2x	<0.02	<4				<70	2922a22	5x	402	79.1			55.2
3901 - B3	156.4	2925a21	2x	0.11	17	0.197	16	108%	290	2922a23	5x	401	62.7	0.156	-9818%	43.8
3901 - B4	196.0	2925a4	2x	0.03±0.01	8±2				(100±30)	2922a3	2x	75.5	14.8			10.3
3901 - B5	200.0	2925a6	2x	<0.02	<4				<70	2922a4	2x	0.22	0.04			0.03
3901 - B6	200.0	2925a5	2x	0.12	24	0.955	20	120%	410	2922a5	2x	1.10	0.22	0.200	88%	0.15
3902 - B1	183.2	2921a18	2x	0.03	5				(80)	2922a28	5x	1060	173			121
4734 - Spike		2925a7	2x	0.12		0.949				2925a7	2x	9.13				
4734 - B1	186.7	2925a8	2x	<0.02	<4				<70	2925a8	2x	2.8±0.7	0.52±0.13			0.36±0.09
4735 - B1	207.0	2925a16	2x	0.03	7				(100)	2925a16	2x	103	21.3			14.9
4738 - B1	183.9	2925a12	2x	0.08	10				(200)	2925a12	2x	164	30.2			21.1
4968 - B1	144.8	2925a14	2x	<0.02	<3				<50	2925a14	2x	352	51.0			35.6
5102 - B1	204.5	2925a22	2x	<0.02	<4				<70	2928a4	2x	3.80	0.78			0.54
5102 Dup	200.0	2925a27	2x	<0.02	<4				<70	2928a22	2x	5.14	1.03			0.72
5150 - B1	189.0	2925a13	2x	0.02	5				(80)	2925a13	2x	314	59.4			41.5
5270 - B1	174.5	2923a16	2x	0.07	13				(200)	2928a13	50x	1830	319			223
5271 - B1	192.7	2923a9	2x	<0.02	<4				<70	2923a9	2x	273	52.6			36.7
5352 - B1	168.0	2923a23	2x	<0.02	<3				<50	2923a23	2x	346	58.1			40.6
5353 - B1	141.0	2923a4	2x	<0.02	<3				<50	2923a4	2x	290	40.9			28.6
5490 - B1	185.3	2923a20	2x	<0.02	<4				<70	2923a20	2x	451	63.6			58.4
5491 - B1	173.7	2923a19	2x	<0.02	<3				<50	2923a19	2x	91.0	15.8			11.0
5492 - B1	192.1	2928a18	2x	<0.02	<4				<70	2928a18	2x	3.05	0.59			0.41
5833 - B1	205.5	2928a7	2x	0.03±0.02	8±4	0.509			100±70	2928a7	2x	39.0	8.01			5.60
5833 - B2	170.1	2923a21	2x	<0.02	<3				<70	2923a21	2x	45.0	7.85			5.35
5833 - B3	194.3	2923a7	2x	0.13	25	0.891	19	100%	426	2923a7	2x	38.0	7.36	0.194	-325%	5.16
5833 - B4	195.9	2923a13	2x	0.1±0.2	20±40				(340±680)	2923a13	2x	72.0	14.1			9.85
5833 - B5	200.0	2928a9	2x	<0.02	<4				<70	2928a9	2x	0.1±0.1	0.02			0.01±0.01
5833 - B6	200.0	2928a10	2x	0.11	22	0.945	20	110%	370	2928a10	2x	0.8±0.2	0.16±0.04	0.200	70%	0.11±0.03
5834 - B1	170.0	2923a5	2x	0.04	7				(100)	2923a5	2x	577	98.1			68.5
5890 - B1	199.4	2923a25	2x	<0.02	<4				<70	2928a20	2x	2.88	0.57			0.40
5877 - B1	185.7	2923a28	2x	0.03±0.04	5±7				(90±100)	2928a12	50x	1310	217			152
5953 - B1	152.2	2923a22	2x	0.08±0.01	12±2				(200±30)	2923a22	2x	698	136			95.3



# 200-BP-1 HOT SOIL ANALYSIS

## Tc-99 and Uranium determinations

Sep. 30, 1992

PNL Sample I.D. #	Digest. Dil Factor	ICP/MS Analysis No.	Analysis Dilution Factor	[Tc-99] ng/ml leachate (d)	[Tc-99] ng/g soil	Ru Correctn Factor	[Tc-99] ng/g spiked	[Tc-99] spike yield, %	[Tc-99] pCi/g, dry soil	ICP/MS Analysis No.	Analysis Dilution Factor	[U] ng/ml leachate (d)	[U] µg/g soil	[U] µg/g spiked	[U] spike yield, %	[U] pCi/g, dry soil
(a)	(b)	No.	Factor	(d)	soil							(d)				
5954 - B1	134.3	2923a27	2x	0.08	10				(200)	2923a27	2x	652	87.6			61.2
6428 - B1	148.9	2921a28	2x	0.02	3				(50)	2922a16	20x	3280	468			341
6713 - B1	189.4	2928a6	2x	<0.02	<4				<70	2922a7	5x	409	77.5			54.1
8726 - B1	187.0	2921a22	2x	0.03	5	0.367			80	2922a8	2x	146	27.3			19.1
6727 - B1	194.2	2921a24	2x	0.03	5				(80)	2922a24	2x	138	26.8			18.7
6904 - B1	184.3	2921a29	2x	<0.02	<4				<70	2922a12	2x	36.6	6.75			4.71
6963 - B1	175.9	2921a6	2x	<0.02	<4				<60	2922a20	5x	449	79.0			55.2
6964 - B1	191.6	2921a32	2x	<0.02	<4				<70	2922a13	2x	211	40.4			28.2
7040 - B1	193.1	2921a23	2x	<0.02	<4				<70	2922a14	2x	2.88	0.56			0.39
7141 - B1	176.6	2921a21	2x	<0.02	<4				<70	2922a19	20x	1730	306			213
7142 - B1	145.7	2921a7	2x	<0.02	<3				<50	2922a6	5x	375	54.6			38.2
1% HNO3		2923a30	1.053X	<0.01						2925a1	1.053X	<0.05				
1% HNO3		2921a1	1.053X	<0.01						2925a23	1.053X	<0.05				
1% HNO3		2921a5	1.053X	<0.01						2925a29	1.053X	<0.05				
1% HNO3		2921a25	1.053X	<0.01						2923a1	1.053X	<0.05				
1% HNO3		2921a34	1.053X	<0.01						2923a14	1.053X	0.30				
HNO3/ H2O Blank		2921a6	2x	<0.01						2922a10	2x	0.08				
50 ppt Tc-99		2925a9	1.053X	0.05												
50 ppt Tc-99		2928a14	1.053X	0.05												
100ppt Tc-99		2921a16	1.053X	0.10												
100ppt Tc-99		2921a20	1.053X	0.09												
500ppt Tc-99		2921a11	1.053X	0.46												
500ppt Tc-99		2921a26	1.053X	0.49												
7.6 pCi/L U										2922a15	1.053X	7.61				
7.6 pCi/L U										2923a15	1.053X	7.56				
7.6 pCi/L U										2928a15	1.053X	8.00				
41.0 pCi/L U										2922a31	1.053X	41.9				
41.0 pCi/L U										2923a29	1.053X	40.0				
41.0 pCi/L U										2925a34	1.053X	42.2				
LCS (287)		2925a10	2x	0.02						2925a10	2x	69.3				
Process Blank		2925a11	2x	<0.02						2925a11	2x	<0.05				
"Spike"		2925a17	2x	0.12						2925a17	2x	<0.05				

9713508.1831

# 200-BP-1 HOT SOIL ANALYSIS

## Tc-99 and Uranium determinations

Sep. 30, 1992

PNL Sample I.D. #	Digest. Dil. Factor	ICP/MS Analysis No.	Analysis Dilution Factor	[Tc-99] ng/ml leachate (d)	[Tc-99] ng/g soil	Ru Correctn Factor	[Tc-99] ng/g spiked	[Tc-99] spike yield, %	[Tc-99] pCi/g, dry soil	ICP/MS Analysis No.	Analysis Dilution Factor	[U] ng/ml leachate (d)	[U] μg/g soil	[U] μg/g spiked	[U] spike yield, %	[U] pCi/g, dry soil
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(a) Sample types:

- B1 = sample
- B2 = sample, duplicate
- B3 = sample + Tc/U spike
- B4 = laboratory control sample
- B5 = procedural blank
- B6 = procedural blank + Tc/U spike

(b) units of mL/g dry soil except for -B5 and -B6 samples (blank/blank spike) units of mL.

(c) additional dilution for analysis

(d) = analyzed concentration X analysis dilution factor

(e) = leachate concentration X digestion dilution factor

(f) -B3 reported in units of ng/g for Tc and μg/g for U; -B6 reported in ng for Tc and μg for U.

(g) estimated fraction of mass 99 actually due to technetium based on natural Ru isotopic abundance.

Because Ru isotopic abundance is suspected to be unnatural, this factor was not used in calculating the final [Tc] result.

(h) = ([Spiked Sample] - [Sample]) / [Spike]

(i) not valid for spiked samples; [U] in soil/leachate >> [U] of added spike

(j) all uranium found to be natural isotopic abundance. Total uranium activity calculated using following formula: pCi/g = [U-238]\*0.338/0.461



GAMMA ENERGY ANALYSIS RESULTS

Ten soil samples were received between April 21, 1992 and May 15, 1992 as part of Sample Delivery Groups #18 and #19 and were analyzed by Gamma Energy Analysis (GEA) as one batch. A duplicate sample and a matrix blank were analyzed per the Test Instructions received. A total of 12 samples were analyzed by GEA. The sample preparation and counting were performed in the 329 building in the 300 Area.

The samples were prepared for counting following PNL-ALO-105. This procedure covers the preparation of solid samples for GEA. The samples were either prepared in a glass scintillation vial (which contained 13 to 16 g of soil and were counted on shelf 2 or shelf 5 of the sample holder for diode L) or in a 2/5 dram polyvial (which contained about 1.0 g of soil and counted on shelf 4 of the sample holder for diode L).

The aliquots taken used the "as received" soil; i.e., the soil was not dried. A percent solids determination has been performed and the results can be found in Table 2 of this report. Therefore, one can convert the reported values to a dry weight basis if desired.

The samples were then analyzed by gamma-ray spectroscopy to determine the quantities of Co-60, Ru-106, and Cs-137 present. This portion of the work was performed following PNL-ALO-464 and PNL-ALO-470. The samples were counted on diode L which is a lithium-drifted germanium [Ge(Li)] detector. Table 10 presents the measured quantities for Co-60, Ru-106, and Cs-137 in the soils. The detection limits quoted are calculated as if the isotope was present at a level that is 2.5 times the square root of twice the average background. For the "hotter" samples, at least two counts were taken of each sample. A short count of 100 to 1000 seconds was taken to obtain a peak for Cs-137 that did not overflow the analyzer and a longer count was taken to obtain better sensitivity for Ru-106 and Co-60 but the peak for Cs-137 may have overflowed the analyzer. Therefore, both counts were used to obtain the recommended values for each isotope in each sample.



Two aliquots of sample 92-07040 (SDG #19) were analyzed. In contrast to the other samples counted, sample 92-07040 was much lower in activity. For Cs-137, the counting error was 18% and 32% for the two samples. The mean and standard deviation was determined to be  $1.88 \pm 1.1\%$  pCi/g. This is well below the required precision for soils of  $\pm 35\%$ .

The detection limits were determined from sample 92-07142-L-5 (SDG #19) which is an empty glass scintillation vial counted on shelf 2 of the sample holder for diode L. The average weight of the preceding 11 samples prepared in the glass scintillation vials was determined to be 14.0 g. This weight was assumed to allow the calculation of detection limits in pCi/g for Co-60, Ru-106, and Cs-137. The detection limits at one sigma are 0.06, 0.7 and 0.05 pCi/g, respectively.

Table 10: Gamma Energy Analysis of Soils

Diode L

(Radionuclide activity in pCi/g<sup>a</sup>)

Sample ID	LRB #	Collection Date	Weight (g)	<sup>60</sup> Co	<sup>106</sup> Ru	<sup>137</sup> Cs
92-06428-L-1	53944-105B	4/16/92 11:00	1.117	<140	<14000	$(1.02 \pm 0.01) \times 10^7$
92-06713-L-1	53944-106A	4/22/92 09:45	15.578	<2	<200	$(9.76 \pm 0.01) \times 10^4$
92-06726-L-1	53944-107A	4/24/92 11:33	13.625	$1.7 \pm 0.2$	<22	$(1.60 \pm 0.02) \times 10^3$
92-06727-L-1	53944-108A	4/24/92 11:33	15.800	<14	<1400	$(9.04 \pm 0.09) \times 10^5$
92-06904-L-1	53944-109A	4/29/92 14:18	14.107	<2	<160	$(1.53 \pm 0.02) \times 10^5$
92-06963-L-1*	53944-110A	5/01/92 09:27	14.672	<7	<610	$(5.44 \pm 0.05) \times 10^5$
92-06964-L-1*	53944-111A	5/04/92 09:58	14.739	<0.4	<27	$(1.58 \pm 0.02) \times 10^4$
92-07040-L-1*	53944-112A	5/07/92 08:50	14.341	<0.3	<1	$1.87 \pm 0.33$
92-07040-L-2*	53944-112B	5/07/92 08:50	13.343	<0.2	<2	$1.90 \pm 0.61$
92-07141-L-1*	53944-113B	5/11/92 14:05	1.277	<60	<5400	$(5.95 \pm 0.06) \times 10^6$
92-07142-L-1*	53944-114A	5/12/92 13:45	13.432	<2	<140	$(9.30 \pm 0.09) \times 10^4$
92-07142-L-5*	53944-115A	5/12/92 13:45	14.0	<0.15	<1.8	<0.12

<sup>a</sup> The one sigma uncertainties are based on counting statistics. All "<" values are detection limits associated with each "not detected" analysis. The detection limits are calculated as if the isotope was present at a level that is 2.5 times the square root of twice the average background.

\* Not a part of this SDG.



TOTAL ALPHA ANALYSIS RESULTS

Five samples from SDG #18, along with the corresponding QC samples, were analyzed for gross alpha content in June 1992 in two batches. They were analyzed in conjunction with samples from SDG #16, #17 and #19. Approximately 0.5 to 5 grams were taken for analysis depending on the sample activity level. The samples were leached per procedure PNL-ALO-106, Acid Digestion for Preparation of Samples for Radiochemical Analysis. Aliquots of the leachate solutions and blanks were taken to perform the alpha analysis. Total alpha analysis proceeded per Procedure PNL-ALO-460, Source Preparation for Gross Alpha Analysis, and PNL-ALO-461, Alpha Counting Procedure. All work was performed in building 329 and 329T5 of the 300 area.

Due to the high activity of the QC samples, the matrix spike could not be added to the soil directly. This would have required a very small soil sample be taken and a large alpha spike added. A small sub-sample size would not necessarily be representative of the whole sample due to sample inhomogeneity. Therefore, a matrix spike recovery could not be accurately calculated. To circumvent this problem, an alpha spike was added to an aliquot of a sample leachate; error due to sampling problems is no longer a factor in determining the matrix spike recovery. This spiking protocol tests all analytical parameters except the leaching process.

The minimum QC criteria were met for the analysis of this SDG. In the first batch, the matrix spike resulted in 91% recovery and the blank spike resulted in 102% recovery. In the second batch, the matrix spike resulted in 80% recovery and the blank spike resulted in 81% recovery. These values indicate an average batch bias of -12% was obtained for this SDG. The precision, estimated by the relative percent difference of the duplicates, are 8% and 34% (first and second batches, respectively). The large RPD obtained for the second batch is within the specification of  $\pm 35\%$ . It can be somewhat deceptive in that it actually represents an average result of  $18 \pm 3$  pCi/g; for a screen, this is completely satisfactory. The largest contribution to the imprecision is estimated to come from the sample heterogeneity. Alpha activity in the blank was not detectable at a level of 1 pCi/g.



A column in the table indicates the normalized blank value. This is a normalization relative to the actual sample size taken for analysis. Due to extremely high activity (in some cases) a very small aliquot of the soil leachate may be analyzed. This would result in a relative blank value quite different from the blank based on a 1 gram equivalent sample size. In the case of a slightly positive blank value, it will help put the sample results in proper perspective, and so it is provided as a courtesy.

Results are reported on an as-received weight; i.e., not dry weight.

No hold times are defined for total alpha analysis.

TABLE 11: TOTAL ALPHA ANALYSIS DATA FOR TASK 2&4  
SDG #18

WHC Sample ID	Sample #	Sample Type	Alpha (pCi/g)	+/- 1 sigma*	Normalized Blank**	RPD	Spike Conc. (pCi/g)	+/- 1 sigma*	Spike % Rec.
First Batch									
B067Y5	92-06428-A-1a	Soil	9279	1143	<430				
B067Y7	92-06713-A-1a	Soil	844	85	<21				
B067Z5	92-06727-A-1a	Soil	82	14	<8				
B067Z5	92-06727-A-2a	Duplicate	75	14	<8	8			
	92-06727-A-3a	Matrix Spike	2085	152	<20		2206	47	91
	92-06727-A-4a	Blank Spike	24.4	1.8	<1		23.96	0.15	102
	92-06727-A-5a	Method Blank	<1						
Second Batch									
B067Z3	92-06726-A-1a	Soil	15.3	2.9	<1				
B067Z3	92-06726-A-2a	Duplicate	21.5	3.3	<1	34			
B06809	92-06904-A-1a	Soil	<1						
	92-05352-A-3a	Matrix Spike	40.5	2.7	<1		50.73	0.63	80
	92-05352-A-4a	Blank Spike	19.3	1.5	<0.2		23.89	0.15	81
	92-05352-A-5a	Method Blank	<1						

\* One sigma uncertainties are based on propagation of mass, volume, and counting uncertainties.

\*\* Blank value normalized to sample size analyzed. See narrative for details.

TOTAL BETA ANALYSIS RESULTS

Five samples from SDG #18, along with the corresponding QC samples, were analyzed for gross beta content in June 1992 in two batches. The samples were run in conjunction with samples from SDG #16, #17 and #19. A nominal 0.5 to 5 grams were taken for analysis, in accordance to the sample activity levels. The samples were leached per procedure PNL-ALO-106, Acid Digestion for Preparation of Samples for Radiochemical Analysis. Aliquots of the leachate solutions and blanks were taken to perform the beta analysis. Total beta analysis proceeded per Procedure PNL-ALO-462, Source Preparation for Gross Beta Analysis, and PNL-ALO-463, Beta Counting Procedure. Detectors are calibrated relative to Sr-90/Y. All work was performed in building 329 and 329T5 of the 300 area.

Due to the high activity of the samples, the matrix spike could not be added to a soil aliquot directly. This would have required a very small soil sample be taken and a large beta spike added. A small sub-sample size would not necessarily be representative of the whole sample due to sample inhomogeneity. Therefore, a matrix spike recovery could not be accurately calculated. To circumvent this problem, a beta spike was added to an aliquot of a sample leachate; error due to sampling problems is no longer a factor in determining the matrix spike recovery. This spiking protocol tests all analytical parameters except the leaching process.

The analysis for total beta activity proceeded smoothly; all QC criteria were met. In the first batch, the matrix spike resulted in 99% recovery and the blank spike resulted in 77% recovery. The second batch matrix spike resulted in 96% recovery, the blank spike resulted in 107% recovery. The average batch bias, based on the average spike recovery, is -5%. The precision, estimated by the relative percent difference of the duplicates, averages 9%.

Beta activity in the blanks was not detected at 10 pCi/g and 16 pCi/g for the first and second batches, respectively. Lower detection limits, specified in the TPP, could be obtained by counting on the low background beta



detectors and analysis of a larger sample. However, this was not necessary due to the high level of sample activity.

The normalized blank value is a normalization relative to the actual sample size taken for analysis. Due to extremely high sample activity, a very small aliquot of the soil leachate is analyzed. This results in a relative blank value quite different from the blank based on a 1 gram equivalent sample size. In case of a positive blank value, it shows the worst case estimated relative contamination. The normalized blank is provided as a courtesy.

Results are reported on an as-received weight; i.e., not dry weight.

No hold times are defined for total beta analysis.

TABLE 12: TOTAL BETA ANALYSIS DATA FOR TASK 2&4  
SDG #18

WHC Sample ID	Sample #	Sample Type	Beta (pCi/g)	+/- 1 sigma*	Normalized Blank**	RPD	Spike Conc. (pCi/g)	+/- 1 sigma*	Spike % Rec.
First Batch									
B067Y5	92-06428-A-1a	Soil	3.96E+07	1.5E+06	<4E+05				
B067Y7	92-06713-A-1a	Soil	1.10E+06	6.5E+04	<9E+03				
B067Z5	92-06727-A-1a	Soil	5.82E+06	2.7E+05	<2E+05				
B067Z5	92-06727-A-2a	Duplicate	5.06E+06	2.6E+05	<2E+05	14			
	92-06727-A-3a	Matrix Spike	5.40E+04	1.7E+03	<5E+02		5.44E+04	2.9E+03	99
	92-06727-A-4a	Blank Spike	7.37E+01	3.1E+00	<2E+00		9.61E+01	4.8E+00	77
	92-06727-A-5a	Method Blank	<1E+01						
Second Batch									
B06809	92-06904-A-1a	Soil	1.09E+06	3.18E+04	<1E+04				
B067Z3	92-06726-A-1a	Soil	1.83E+04	6.03E+02	<3E+02				
B067Z3	92-06726-A-2a	Duplicate	1.75E+04	5.87E+02	<3E+02	4			
	92-06726-A-3a	Matrix Spike	6.37E+02	1.05E+01	<3E+02		6.66E+02	1.9E+01	96
	92-05352-A-4a	Blank Spike	2.56E+02	5.82E+00	<3E+00		2.39E+02	9.0E+00	107
	92-05352-A-5a	Method Blank	<1.6E+01						

\*One sigma uncertainties are based on propagation of mass, volume, and counting uncertainties.

\*\*Blank value normalized to sample size analyzed. See narrative for details.

PLUTONIUM ANALYSIS RESULTS

Plutonium analyses were performed on samples from SDG #18 along with samples from SDG #16, #17 and #19 and the corresponding QC samples. The analyses were split into two analytical batches based on activity level. For the SDG #18 samples in the first batch a nominal 1 gram sample was leached for B067Y7 and B067Z5 and a nominal 0.5 gram sample for B067Y5. For the second batch a nominal 2 gram sample was leached for B06809 and a nominal 5 gram sample for B067Z3. An aliquot of each sample leachate was taken for analysis. This was necessary due to the relatively high level of activity in the samples. The leach procedure used was PNL-ALO-106, Acid Digestion for Preparation of Samples for Radiochemical Analysis. Analysis was completed according to Procedures PNL-ALO-466, Plutonium Separation, PNL-ALO-468, Electroplating, and PNL-ALO-469, Alpha Energy Analysis. All work was performed in building 329 and 329T5 in the 300 area.

All samples, after leaching, were spiked with Pu-242 tracer which was used to correct for the radiochemical yield of each individual sample. The Pu-239 recoveries for the blank spikes are excellent at 99% and 101% for the two batches. These indicate an average batch bias of 0%. The target accuracy is  $\pm 25\%$ . For the first batch the duplicate sample has a relative percent difference (RPD) of 0.8% for Pu-239+240 and 14% for Pu-238. The higher RPD for Pu-238 is consistent with the higher uncertainties of the individual Pu-238 measurements. For the second batch the duplicate sample contains a non-detectable activity of Pu-238 so a RPD could not be calculated for this isotope. For Pu-239 the RPD is 7%. All RPD's are within the project target of  $\pm 35\%$  precision. No detectable amount of Pu-239+240 or Pu-238 was found in the blanks for either batch.

The results for the blanks and blank spikes are reported in pCi. In addition, the blank results have been normalized against the samples (based on actual mass analyzed after leaching, dilution and aliquoting) to provide a more meaningful value relative to each sample value.

The results are reported per received sample weight (not corrected for weight percent solids). No hold times are defined for plutonium analyses.



TABLE 13: PLUTONIUM ANALYSIS DATA FOR TASK 2&4  
SDG #18

Client Sample ID	Program Sample ID	Sample Type	Pu-239+240 pCi/g	+/- 1 sigma	Pu-239+240 RPD	Pu-239+240 Normalized Blank*** pCi/g	Pu-238 pCi/g	+/- 1 sigma	Pu-238 RPD	Pu-238 Normalized Blank*** pCi/g	Pu-239 Spike pCi/sample	+/- 1 sigma	% Recovery
Batch #1													
B067Y5	92-06428-A-1c	Soil	5.85E+03	1.99E+02		<1.2 E+01	2.03E+02	1.31E+01		<7.7 E+00			
B067Y7	92-06713-A-1c	Soil	6.87E+02	2.35E+01		<1.4 E+00	2.78E+01	1.72E+00		<9.5 E-01			
B067Z5	92-06727-A-1c	Soil	1.26E+02	4.73E+00		<5.6 E-01	1.70E+00	2.76E-01		<3.7 E-01			
B067Z5	92-06727-A-2c	Duplicate	1.25E+02	4.66E+00	0.8	<5.4 E-01	1.95E+00	2.85E-01	14	<3.6 E-01			
	92-06727-A-5c	Blank*	<3.4 E-02				<2.4 E-02						
	92-06727-A-4c	Blank Spike*	4.76E+01	1.20E+00			<5.7 E-03				4.81E+01	3.00E-01	99
Batch #2													
B067Z3	92-06726-A-1c	Soil	9.60E-02	2.11E-02		<2.4 E-02	<8.9 E-03			<2.4 E-02			
B067Z3	92-06726-A-2c	Duplicate	1.03E-01	2.20E-02	7	<2.4 E-02	<1.1 E-02		NA	<2.4 E-02			
B06809	92-06904-A-1c	Soil	2.09E+01	7.61E-01		<2.1 E-02	2.32E-01	3.15E-02		<2.1 E-02			
	92-05352-A-5c	Blank**	<1.3 E-02				<1.2 E-02						
	92-05352-A-4c	Blank Spike**	1.21E+01	3.11E-01			<1.9 E-03				1.20E+01	1.00E-01	101

\* Reported in pCi.

\*\* Reported in pCi. Not in this SDG. Reported for QC purposes only.

\*\*\* Blank value when normalized to actual sample size analyzed.

One sigma uncertainties are the propagated error of individual measurements.

Using a 1 gram sample size results in a detection limit of approximately 3 E-2 pCi/g for Pu-239+240 and 2 E-2 pCi/g for Pu-238.

STRONTIUM ANALYSIS RESULTS

Sr-90 analyses of SDG #18 were performed in two batches along with samples from SDG #17 and #19. A nominal 0.5 to 5 gram sample size (depending on sample activity) was taken for analysis. The samples were leached per procedure PNL-ALO-106, Acid Digestion for Preparation of Samples for Radiochemical Analysis. The sample leachates were diluted serially and aliquots of appropriate activity were taken for Sr-90 analysis. The strontium analysis continued per Procedure PNL-ALO-465, Strontium-90 Analysis (Oxalate-Nitric Acid Method), and PNL-ALO-463, Beta Counting Procedure. All analytical work and calculations were performed in building 329 and 329T5 of the 300 area.

Due to the high Sr-90 activity of the samples, the matrix spike could not be added to a soil aliquot directly. This would have required a very small soil sample be taken and a large Sr-90 spike added. A small sub-sample size would not necessarily be representative of the whole sample due to sample inhomogeneity, and would most probably cause an inaccurate matrix spike recovery calculation. To circumvent this problem, a Sr-90 spike was added to an aliquot of a sample leachate; error due to sampling problems is no longer a factor in determining the matrix spike recovery. This spiking protocol tests all analytical parameters except the leaching process. Previous experience with spiked soils indicate no problems should be anticipated with the dissolution and recovery of Sr with the leaching process.

The analysis for Sr-90 proceeded smoothly. The yield spike of a known blank soil was used to determine the batch yield. The yields of the two batches agreed well: 91% and 95%. All samples of each batch are calculated on the basis of the ratio of the corresponding yield spike recovery normalized to 100% chemical recovery.

The blank spike consisted of 8M  $\text{HNO}_3$  and resulted in 108% (first batch) and 122% (second batch) recoveries. A matrix spike was run with the first batch which consisted of an aliquot of B067Z5 soil leachate spiked with Sr-90 and it resulted in 106% recovery. The second batch matrix spike sample

consisted of an aliquot of B06723 soil leachate and resulted in 91% recovery of Sr-90. Based on the blank and matrix spike recoveries, the overall batch bias is calculated to be +7%. The overall precision, estimated by the relative percent difference of the duplicates, is  $\pm 10\%$ .

Sr-90 activity in the blank was detected in both batches (74 pCi/g and 10 pCi/g). These blank values are generally the result of contamination from the samples themselves into the blank. It is believed to occur during the final plating stage. Because the samples themselves contain high activity, an insignificant fraction of a sample contaminating the blank can cause a large signal in the blank. The blank contamination is insignificant relative to the sample values (see the normalized blank in the accompanying table).

The normalized blank value is a normalization relative to the actual sample size taken for analysis. Due to extremely high sample activity, a very small aliquot of the soil leachate is analyzed. This results in a relative blank value quite different from the blank based on a 1 gram equivalent sample size. In this case of a positive blank value, it shows the worst case estimated relative contamination, that is, if contamination occurred at the beginning, during the sampling or leaching process.

The Sr-90 analysis does not correct for the presence of Sr-89; all activity is assumed to be from Sr-90. Results are reported on an as-received weight; i.e., not dry weight.

No hold times are defined for Sr-90 analysis.



TABLE 14: STRONTIUM-90 ANALYSIS DATA FOR TASKS 2 &amp; 4 SDG 18

WHC Sample ID	Parameters of Interest		Strontium (pCi/g)	+/- 1 sigma*	Normalized Blank***	RPD	Spike Conc. (pCi/g)	+/- 1 sigma*	Spike % Rec.	Normalized % Yield**
	Sample #	Sample Type								
First Batch										
B067Y5	92-06428-A-1b	Soil	1.42E+07	1.2E+06	5.8E+05	10	2.20E+03	1.2E+02	106	91
B067Y7	92-06713-A-1b	Soil	5.29E+05	5.2E+04	1.4E+04					
B067Z5	92-06727-A-1b	Soil	2.36E+06	2.2E+05	2.2E+05					
B067Z5	92-06727-A-2b	Duplicate	2.60E+06	2.3E+05	2.1E+05					
	92-06727-A-3b	Matrix Spike	2.34E+03	2.0E+02	6.7E+01					
	92-06727-A-3b	Yield Spike	Used to determine Batch yield							
	92-06727-A-4b	Blank Spike	1.28E+02	1.1E+01	7.4E+01					
	92-06727-A-5b	Method Blank	7.38E+01	7.7E+00						
Second Batch										
B06809	92-06904-A-1b	Soil	5.36E+05	4.3E+04	3.0E+03	9	2.37E+04	1.0E+03	91	95
B067Z3	92-06726-A-1b	Soil	8.65E+03	7.1E+02	1.0E+02					
B067Z3	92-06726-A-2b	Duplicate	8.07E+03	6.6E+02	1.1E+02					
	92-06726-A-3b	Matrix Spike	2.99E+04	2.3E+03	1.0E+02					
	92-06726-A-3b	Yield Spike	Used to determine Batch yield							
	92-06726-A-4b	Blank Spike	1.45E+02	1.3E+01	2.1E+00					
	92-06726-A-5b	Method Blank	1.03E+01	2.5E+00						

\*One sigma uncertainties are based on propagation of mass, volume, and counting uncertainties.

\*\*All Sr-90 analyses are calculated on the basis of their ratio to the matrix spike recovery which has been normalized to 100% chemical recovery.

\*\*\*Blank value when normalized to actual sample mass analyzed.

TRITIUM ANALYSIS RESULTS

Five soil samples from SDG #18, and their corresponding QC samples were prepared and analyzed according to procedures PNL-ALO-441, Radionuclide Separation and Analysis Procedure for Tritium, and PNL-ALO-443, Liquid Scintillation Counting Procedure for Tritium. Two other SDG groups, #17 and #19, were also analyzed with this set. The leaching, distillation and counting were performed in building 329 in the 300 area.

A nominal 5 grams were initially sub-sampled for leaching. After leaching and a double distillation, the aliquots counted are equivalent to approximately 0.4 g. The QC sample for this set comes from SDG #19, 92-06964. A pre-leached sample (92-06964) is used to determine the batch yield or recovery correction factor ( $F_s$ ). The recovery correction factor is applied to each analytical result in the batch. The batch yield is 87.5%. This is consistent with past experience.

The duplicate values of the QC sample are 7.9 and <4 pCi/g. Because these values are respectively close to and at the detection limit, the relative percent difference can not be calculated. At levels of up to about 5 times the detection limit, precision of any analytical method tends to be poor. The blank spike consists of a pre-leached sample (92-06964, duplicate) with a known amount of tritium spike added. It is essentially a duplicate of the batch yield sample described above. The blank spike recovery of 86% is obtained. The matrix spike sample consists of an as received sample (92-06964) to which a known tritium spike is added. Recovery of the matrix spike shows good recovery of 91%. Averaging both blank spike and matrix spike recoveries results in 89% average recovery, indicating an average -11% batch bias.

The blank result, normalized to a 5 gram sample size, shows tritium is not detected at 4 pCi/g.

This procedure was conducted according to the corrective actions described in the deficiency report, 91-105. It allows us to operate more

effectively for the soil analysis and allows for better equation application to the procedure. It has been in effect for almost one year.

The sample results are reported per received sample weight.

No hold times are defined for tritium analysis.



TABLE 15: TRITIUM ANALYSIS DATA FOR TASKS 2 &amp; 4 SDG 18

WHC Sample ID	Sample #	Sample Type	Tritium (pCi/g)	+/- 1 sigma*	RPD	Conc. (pCi/g)	+/- 1 sigma*	Spike % Rec.	RCF Fs**
B067Y5	92-06428-K-1	Soil	15.0	1.6					
B067Y7	92-06713-K-1	Soil	13.3	1.6					
B067Z3	92-06726-K-1	Soil	194.2	5.4					
B067Z5	92-06727-K-1	Soil	41.5	1.9					
B06809	92-06904-K-1	Soil	32.1	2.8					
	92-06964-K-1+	Soil	7.9	1.3					
	92-06964-K-2+	Duplicate	< 4		na				
	92-06964-K-4+	Matrix Spike	707	15		766	14	91	
	92-06964-K-4+	Blank Spike	3618	75		4193	75	86	
	92-06964-K-5+	Method Blank	< 4						
	92-06964-K-4+	Yield spike to determine Fs							87.5

\* One sigma uncertainties are based on propagation of mass, volume, and counting uncertainties.

\*\* Recovery Correction Factor, Fs.

na: not applicable

+ Included for QC purposes.

TOTAL ORGANIC CARBON ANALYSIS RESULTS

The following samples (SDG #18) were prepared by procedure PNL-ALO-380, rev. 0, "Determination of Carbon in Solids Using the Coulometrics Carbon Dioxide Coulometer":

<u>ACL Number</u>	<u>WHC Number</u>	<u>ACL Number</u>	<u>WHC Number</u>
92-06428	- B067Y5	92-06727	- B067Z5
92-06713	- B067Y7	92-06904	- B06809
92-06726	- B067Z3		

The procedure methodology is consistent with SW 846 method 9060. PNL-ALO-380 defines the operation of the instrument used as well as the analysis of the sample. SW 846 method 9060 leaves the option for the analyst to follow the manufacturer's instrument instructions for calibration, analysis procedure, and calculations.

Blank Determination

With the Coulometrics TOC system, an average (daily) blank must be determined prior to calibration check of the instrument and analysis of samples. The major carbon source in the blank is CO<sub>2</sub> adsorbed on the sample boat and ladle. The blank is obtained by removing the quartz ladle and sample boat (platinum or porcelain) from the furnace tube and exposing them to air. These parts are then placed back into the furnace and carbon analysis is performed on this blank. This procedure is repeated until consecutive blank values differ by no more than 0.5 µg of total organic carbon for every 10 minutes of analysis time. As there is no sample preparation prior to analysis, this instrument blank is also considered to be the methods blank when determining TOC by this method.

Detection Limits

The blank thus obtained has a direct effect on the quantification limit for each sample as this value must be subtracted from each sample value determined. However, this blank value is not an indicator of instrument

sensitivity, and should not be considered as an indication of the true instrument detection limit. If the instrument were operated in a carbon-free atmosphere, a lower blank value could be observed. It is not possible to determine an absolute instrument detection limit (i.e., a measurement of instrument sensitivity) under current laboratory operating conditions. For purposes of this report, the daily blank value is used as the lower quantification limit for the analyses. Reported results indicate that sample organic carbon levels are above this method quantification limit (instrument background carbon levels).

An average "method detection limit" for this analytical method may be estimated from the absolute difference between consecutive blank values. The "method detection limit", defined as three times this difference, is approximately  $1 \mu\text{g}$  total organic carbon. The method detection limit expressed in concentration terms would be dependent on the sample size analyzed.

#### Standard Analysis

A Kodak glucose standard was analyzed in duplicate as an initial one point calibration of the instrument. The manufacturer's manual states to use a single point calibration of the instrument as the instrument exhibits a linear response. Each standard determination consisted of a 30 or 35 minute analysis and reported results are corrected with the corresponding average blank value. Initial recoveries of the same glucose standard on 5/4/92 were 96.7% & 96.8%, with an average of 96.7%, and a relative percent difference (RPD) of 0.1%. Standard recoveries on 5/15/92 were 99.9% and 99.0%, with an average of 99.4%, and a RPD of 0.9%. Based on duplicate analysis results, estimated precision from this set of data is  $\pm 0.1\%$  relative, with a bias (accuracy) of  $-3.3\%$  on the average for 5/4/92 analyses, and  $\pm 0.9\%$  with a bias of  $-0.6\%$  on the average for 5/15/92 analyses. Reported sample values are corrected for the corresponding average initial standard recoveries.

An additional glucose standard analysis was performed after sample analysis on 5/4/92. Standard recovery was an acceptable 99.4%.



### Sample Analysis

All samples were first screened, and then analyzed in at least duplicate (as specified in TI-200BP-1-200, 203, 207, and 211) for 30 (5/4/92) or 35 minutes (5/15/92) at ~500 °C. The RPD between duplicate analyses ranged from 0.2% to 22.9%. Replicate analysis deviation is mostly attributed to the inherent heterogeneity of the soil samples received, and the small sample sizes analyzed. Due to the small sample size required (2 - 100+ mg), a selective sub-sample of smaller soil particles is necessary. The very nature of this sample selection process may bias reported carbon results and increase deviation between replicate analyses.

Reported sample organic carbon levels are not adjusted for moisture content of the soil matrix.

### Hold Times

The Environmental Protection Agency (EPA) hold time for Total Organic Carbon Analysis in soils is defined at 14 days from the date of sampling. The hold times were met for these samples.

TABLE 16: TOTAL ORGANIC CARBON ANALYSIS DATA FOR TASKS 2 & 4  
SDG #18

Soil Samples

WHC Sample	PNL ALO #	Sample Type	Sample Wt. g	ug C Results	ug C in Sample	mgC/Kg Sample	RPD Dups	% Rec.* Standard	Date Received	Date Analyzed
B067Y5	92-06428-1	Sample	0.06603	29.07	19.45	305	20.8		4-21-92	5-04-92
B067Y5	92-06428-2	Duplicate	0.07887	38.29	28.67	376			4-21-92	5-04-92
B067Y7	92-06713-1	Sample	0.06540	17.38	7.76	123	6.7		4-27-92	5-04-92
B067Y7	92-06713-2	Duplicate	0.05626	15.89	6.27	115			4-27-92	5-04-92
B067Z3	92-06726-1	Sample	0.06615	47.16	37.54	587	0.2		4-29-92	5-04-92
B067Z3	92-06726-2	Duplicate	0.05788	42.53	32.92	588			4-29-92	5-04-92
B067Z5	92-06727-1	Sample	0.05867	106.30	96.68	1700	6.8		4-29-92	5-04-92
B067Z5	92-06727-2	Duplicate	0.04568	90.23	80.61	1820			4-29-92	5-04-92
B067Z5	92-06727-3	Standard	0.00486	1888.70	1879.08		0.1	96.7		5-04-92
B067Z5	92-06727-3	Std Dup	0.00675	2621.97	2612.35			96.8		5-04-92
B067Z5	92-06727-4	Blank		9.62						5-04-92
		Standard 2	0.00611	2437.97	2428.35			99.4		5-04-92
B06809	92-06904-1	Sample	0.04626	59.01	31.33	681	22.9		5-04-92	5-15-92
B06809	92-06904-2	Duplicate	0.04531	52.04	24.36	541			5-04-92	5-15-92
B06809	92-06904-3	Standard	0.00580	2346.14	2318.46		0.9	99.9		5-15-92
B06809	92-06904-3	Std Dup	0.00521	2089.98	2062.30			99.0		5-15-92
B06809	92-06904-4	Blank		27.68						5-15-92

\* Based on standard carbon content of 40.0% by weight.

Standard 2: 1st post-sample standard analyzed

Total Organic Carbon by Procedure PNL-ALO-380, on Instrument WA92040, 325 Bldg.,  
rm 701. Data reported from Carbon Analysis Data Sheets of same date.

VOLATILE ORGANIC COMPOUND ANALYSIS REPORTSAMPLE ANALYSIS REPORTED

Analysis of four soil samples for volatile organic compounds by gas chromatography/mass spectrometry (GC/MS) is the subject of this report.

SAMPLE DESCRIPTION

<u>Sample ID</u>	<u>ACL Lab Number</u>	<u>Date received</u>
B067Y7	92-06713	04/27/92
B067Y5	92-06428	04/21/92
B067Z3	92-06726	04/29/92
B067Z5	92-06727	04/29/92

The samples, B067Y7, B067Y5, B067Z3, and B067Z5 were received on the dates specified above in the 325 Building. These samples are referred to as part of SDG #18.

SAMPLE PREPARATION

The preparation and analysis followed EPA-CLP SOW 2/88 procedures for the analysis of volatile compounds in soils.

ANALYSIS METHOD

- |                          |                               |
|--------------------------|-------------------------------|
| • GC/MS procedure:       | PNL-ALO-335.                  |
| • GC/MS instrumentation: | HP-5890/5970 GC/MS (WB46864). |
| • GC/MS location:        | Lab 327-A, 325 building       |

QUALITY CONTROL

Quality control procedures specified for this method were followed. The quality assurance performance requirements are summarized as follows:

<u>Form</u>	<u>Information</u>	<u>Comments</u>
2B	Surrogate Recovery	DCE high due to matrix (see RESULTS section) in 92-06727 Dupe.



		Otherwise, it meets all requirements.
3B	MS/MSD Recovery	Meets all requirements.
4A	Method Blank Summary	Meets all requirements.
5A	Tune/Mass Calibration	Meets all requirements.
6A	Initial Calibration	5 point calibration. Meets all requirements.
7A	Daily Calibration	Meets all requirements.
8A	Internal Standards	Recovery of one standard low for 92-06727 and all three were low for 92-06727 DUPE. These were due to the hydrocarbon matrix, (see RESULTS section). With the other samples it meets all requirements.

## RESULTS

CLP Target Compounds: The attached 1A Forms show that volatile target compound Acetone and 2-Hexanone were observed in the BLANK. However, they were below the Contract Required Quantitation Limit, (CRQL). Acetone and Toluene were observed, but were below the CRQL, in 92-06726 and 92-06726 DUPE. Acetone was observed above the CRQL in 92-06428 and 92-06428 DUPE. Acetone and Toluene were observed above the CRQL in 92-06727 and 92-06727 DUPE. However, the numbers should be considered tentative data, since this sample did not meet QC requirements due to the large amount of hydrocarbons present in it. Reanalysis, with sample cleanup was recommended by the Analyst and Technical Group Leader, however, per OSM instructions, no further analysis was performed. Acetone was observed above the CRQL and 1,1,1-Trichloroethane was observed below the CRQL in 92-06713 and 92-06713 DUPE.

In summary, no CLP Target Compounds were observed in the sample 92-06726 above the quantitation limits. However, CLP Target compounds were observed in 92-06713, 92-06428, and 92-06727 above the quantitation limits.

The following defines the qualifiers, Q-flags, in the Form 1's:

"Q" Flag	Definition
U	Indicates the compound was analyzed for but not detected, the U-flagged concentration number is the CRQL.
J	Indicates an estimated value for the target or tentatively identified compounds, spectra meet criteria but response is below the CRQL for the target compounds.
B	Compound was found in the blank.
X	Indicates compound was manually deleted because all requirements were not met.
D	Analysis was performed on a diluted sample.
E	Indicates that Quantitation was outside the calibration range.
!	Indicates that sample did not meet QC requirements and the result should be interpreted accordingly.

Tentatively Identified Compounds: As shown in the attached 1E forms, there were no non-CLP target Compounds in the Blank. Additionally, no non-CLP target compounds were observed in sample 92-06713 or 92-06713 DUPE.

In sample 92-06727 and 92-06727 DUPE, a series of late coeluting Unknowns were observed at the ppm level. The mass spectra of the broad hump indicates the presence of both Alkanes and Alkenes. Additionally, another, earlier eluting, Unknown was observed in 92-06727 DUPE.

Samples 92-06726, 92-06726 DUPE, 92-06428, and 92-06428 DUPE also contained these late eluting Unknowns, but at a much lower concentration level than observed in 92-06727.



1A  
VOLATILE ORGANICS ANALYSIS DATA SHEET

EPA SAMPLE NO.

92-06713

Lab Name: BATTELLE-PNL

Contract: -----

Lab Code: -----

Case No.: -----

SAS No.: -----

SDG No.: 18

Matrix: (soil/water) SOIL

Lab Sample ID: B067Y7

Sample wt/vol: 5.406 (g/mL) G

Lab File ID: &gt;PD004

Level: (low/med) LOW

Date Received: 04/27/92

% Moisture: not dec.2.5

Date Analyzed: 4/30/92

Column: (pack/cap) CAP

Dilution Factor: 1.00000

CAS NO.	COMPOUND	CONCENTRATION UNITS:	
		(ug/L or ug/Kg)	ug/Kg
			Q
74-87-3-----	Chloromethane	9.	U
74-83-9-----	Bromomethane	9.	U
75-01-4-----	Vinyl Chloride	9.	U
75-00-3-----	Chloroethane	9.	U
75-09-2-----	Methylene Chloride	5.	U
67-64-1-----	Acetone	17.	B
75-15-0-----	Carbon Disulfide	5.	U
75-35-4-----	1,1-Dichloroethene	5.	U
75-34-3-----	1,1-Dichloroethane	5.	U
540-59-0-----	1,2-Dichloroethene (total)	5.	U
67-66-3-----	Chloroform	5.	U
107-02-2-----	1,2-Dichloroethane	5.	U
78-93-3-----	2-Butanone	9.	U
71-55-6-----	1,1,1-Trichloroethane	1.	J
56-23-5-----	Carbon Tetrachloride	5.	U
108-05-4-----	Vinyl Acetate	9.	U
75-27-4-----	Bromodichloromethane	5.	U
78-87-5-----	1,2-Dichloropropane	5.	U
10061-01-5-----	cis-1,3-Dichloropropene	5.	U
79-01-6-----	Trichloroethene	5.	U
124-48-1-----	Dibromochloromethane	5.	U
79-00-5-----	1,1,2-Trichloroethane	5.	U
71-43-2-----	Benzene	5.	U
10061-02-6-----	trans-1,3-Dichloropropene	5.	U
75-25-2-----	Bromoform	5.	U
108-10-1-----	4-Methyl-2-pentanone	9.	U
591-78-6-----	2-Hexanone	9.	U
127-18-4-----	Tetrachloroethene	5.	U
79-34-5-----	1,1,2,2-Tetrachloroethane	5.	U
108-88-3-----	Toluene	5.	U
108-90-7-----	Chlorobenzene	5.	U
100-41-4-----	Ethylbenzene	5.	U
100-42-5-----	Styrene	5.	U
133-02-7-----	Xylene (total)	5.	U



1E  
VOLATILE ORGANICS ANALYSIS DATA SHEET  
TENTATIVELY IDENTIFIED COMPOUNDS

EPA SAMPLE NO.

92-06713

Lab Name: BATTELLE-PNL

Contract: -----

Lab Code: -----

Case No.: -----

SAS No.: -----

SDG No.: 18

Matrix: (soil/water) SOIL

Lab Sample ID: B067Y7

Sample wt/vol: 5.406 (g/mL) G

Lab File ID: &gt;PD004

Level: (low/med) LOW

Date Received: 04/27/92

% Moisture: not dec.2.5

Date Analyzed: 04/30/92

Column: CAP

Dilution Factor: 1.00

Number TICs found: 0

CONCENTRATION UNITS:  
(ug/L or ug/Kg) ug/Kg

CAS NUMBER	COMPOUND NAME	RT	EST. CONC.	Q
1.				
2.				
3.				
4.				
5.				
6.				
7.				
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9.				
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29.				
30.				

1A  
VOLATILE ORGANICS ANALYSIS DATA SHEET

EPA SAMPLE NO.

92-06428

Lab Name: BATTELLE-PNL

Contract: -----

Lab Code: -----

Case No.: -----

SAS No.: -----

SDG No.: 18

Matrix: (soil/water) SOIL

Lab Sample ID: B067Y5

Sample wt/vol: 4.170 (g/mL) G

Lab File ID: &gt;PD008

Level: (low/med) LOW

Date Received: 04/21/92

% Moisture: not dec.3.2

Date Analyzed: 4/30/92

Column: (pack/cap) CAP

Dilution Factor: 1.00000

CAS NO.	COMPOUND	CONCENTRATION UNITS:		Q
		(ug/L or ug/Kg)	ug/Kg	
74-87-3-----	Chloromethane	12.	U	
74-83-9-----	Bromomethane	12.	U	
75-01-4-----	Vinyl Chloride	12.	U	
75-00-3-----	Chloroethane	12.	U	
75-09-2-----	Methylene Chloride	6.	U	
67-64-1-----	Acetone	23.	B	
75-15-0-----	Carbon Disulfide	6.	U	
75-35-4-----	1,1-Dichloroethene	6.	U	
75-34-3-----	1,1-Dichloroethane	6.	U	
540-59-0-----	1,2-Dichloroethene (total)	6.	U	
67-66-3-----	Chloroform	6.	U	
107-02-2-----	1,2-Dichloroethane	6.	U	
78-93-3-----	2-Butanone	12.	U	
71-55-6-----	1,1,1-Trichloroethane	6.	U	
56-23-5-----	Carbon Tetrachloride	6.	U	
108-05-4-----	Vinyl Acetate	12.	U	
75-27-4-----	Bromodichloromethane	6.	U	
78-87-5-----	1,2-Dichloropropane	6.	U	
10061-01-5-----	cis-1,3-Dichloropropene	6.	U	
79-01-6-----	Trichloroethene	6.	U	
124-48-1-----	Dibromochloromethane	6.	U	
79-00-5-----	1,1,2-Trichloroethane	6.	U	
71-43-2-----	Benzene	6.	U	
10061-02-6-----	trans-1,3-Dichloropropene	6.	U	
75-25-2-----	Bromoform	6.	U	
108-10-1-----	4-Methyl-2-pentanone	12.	U	
591-78-6-----	2-Hexanone	12.	U	
127-18-4-----	Tetrachloroethene	6.	U	
79-34-5-----	1,1,2,2-Tetrachloroethane	6.	U	
108-88-3-----	Toluene	6.	U	
108-90-7-----	Chlorobenzene	6.	U	
100-41-4-----	Ethylbenzene	6.	U	
100-42-5-----	Styrene	6.	U	
133-02-7-----	Xylene (total)	6.	U	



1E  
VOLATILE ORGANICS ANALYSIS DATA SHEET  
TENTATIVELY IDENTIFIED COMPOUNDS

EPA SAMPLE NO.

92-06428

Lab Name: BATTELLE-PNL

Contract: -----

Lab Code: -----

Case No.: -----

SAS No.: -----

SDG No.: 18

Matrix: (soil/water) SOIL

Lab Sample ID: B067Y5

Sample wt/vol: 4.170 (g/mL) G

Lab File ID: &gt;PD008

Level: (low/med) LOW

Date Received: 04/21/92

% Moisture: not dec.3.2

Date Analyzed: 4/30/92

Column: CAP

Dilution Factor: 1.00000

Number TICs found: 1

CONCENTRATION UNITS:  
(ug/L or ug/Kg) ug/Kg

CAS NUMBER	COMPOUND NAME	RT	EST. CONC.	Q
1.	Unknowns	30-35	14100.	J
2.				
3.				
4.				
5.				
6.				
7.				
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27.				
28.				
29.				
30.				



1A  
VOLATILE ORGANICS ANALYSIS DATA SHEET

EPA SAMPLE NO.

92-06726

Lab Name: BATTELLE-PNL

Contract: -----

Lab Code: -----

Case No.: -----

SAS No.: -----

SDG No.: 18

Matrix: (soil/water) SOIL

Lab Sample ID: B067Z3

Sample wt/vol: 5.027 (g/mL) G

Lab File ID: &gt;PD010

Level: (low/med) LOW

Date Received: 04/29/92

% Moisture: not dec.3.4

Date Analyzed: 4/30/92

Column: (pack/cap) CAP

Dilution Factor: 1.00000

CAS NO.	COMPOUND	CONCENTRATION UNITS: (ug/L or ug/Kg) ug/Kg	Q
---------	----------	---	---

74-87-3-----	Chloromethane	10.	U
74-83-9-----	Bromomethane	10.	U
75-01-4-----	Vinyl Chloride	10.	U
75-00-3-----	Chloroethane	10.	U
75-09-2-----	Methylene Chloride	5.	U
67-64-1-----	Acetone	6.	JB
75-15-0-----	Carbon Disulfide	5.	U
75-35-4-----	1,1-Dichloroethene	5.	U
75-34-3-----	1,1-Dichloroethane	5.	U
540-59-0-----	1,2-Dichloroethene (total)	5.	U
67-66-3-----	Chloroform	5.	U
107-02-2-----	1,2-Dichloroethane	5.	U
78-93-3-----	2-Butanone	10.	U
71-55-6-----	1,1,1-Trichloroethane	5.	U
56-23-5-----	Carbon Tetrachloride	5.	U
108-05-4-----	Vinyl Acetate	10.	U
75-27-4-----	Bromodichloromethane	5.	U
78-87-5-----	1,2-Dichloropropane	5.	U
10061-01-5-----	cis-1,3-Dichloropropene	5.	U
79-01-6-----	Trichloroethene	5.	U
124-48-1-----	Dibromochloromethane	5.	U
79-00-5-----	1,1,2-Trichloroethane	5.	U
71-43-2-----	Benzene	5.	U
10061-02-6-----	trans-1,3-Dichloropropene	5.	U
75-25-2-----	Bromoform	5.	U
108-10-1-----	4-Methyl-2-pentanone	10.	U
591-78-6-----	2-Hexanone	10.	U
127-18-4-----	Tetrachloroethene	5.	U
79-34-5-----	1,1,2,2-Tetrachloroethane	5.	U
108-88-3-----	Toluene	3.	J
108-90-7-----	Chlorobenzene	5.	U
100-41-4-----	Ethylbenzene	5.	U
100-42-5-----	Styrene	5.	U
133-02-7-----	Xylene (total)	5.	U

1E  
VOLATILE ORGANICS ANALYSIS DATA SHEET  
TENTATIVELY IDENTIFIED COMPOUNDS

EPA SAMPLE NO.

92-06726

Lab Name: BATTELLE-PNL

Contract: -----

Lab Code: -----

Case No.: -----

SAS No.: -----

SDG No.: 18

Matrix: (soil/water) SOIL

Lab Sample ID: B06723

Sample wt/vol: 5.027 (g/mL) G

Lab File ID: &gt;PD010

Level: (low/med) LOW

Date Received: 04/29/92

% Moisture: not dec.3.4

Date Analyzed: 4/30/92

Column: CAP

Dilution Factor: 1.00000

Number TICs found: 1

CONCENTRATION UNITS:  
(ug/L or ug/Kg) ug/Kg

CAS NUMBER	COMPOUND NAME	RT	EST. CONC.	Q
1.	Unknowns	28-35	860.	J
2.				
3.				
4.				
5.				
6.				
7.				
8.				
9.				
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1A  
VOLATILE ORGANICS ANALYSIS DATA SHEET

EPA SAMPLE NO.

92-06727

Lab Name: BATTELLE-PNL

Contract: -----

Lab Code: -----

Case No.: -----

SAS No.: -----

SDG No.: 18

Matrix: (soil/water) SOIL

Lab Sample ID: B067Z5

Sample wt/vol: 5.143 (g/mL) G

Lab File ID: &gt;PD012

Level: (low/med) LOW

Date Received: 04/29/92

% Moisture: not dec.2.2

Date Analyzed: 4/30/92

Column: (pack/cap) CAP

Dilution Factor: 1.00000

CAS NO.	COMPOUND	CONCENTRATION UNITS: (ug/L or ug/Kg) ug/Kg	Q
---------	----------	---	---

74-87-3-----	Chloromethane	10.	U
74-83-9-----	Bromomethane	10.	U
75-01-4-----	Vinyl Chloride	10.	U
75-00-3-----	Chloroethane	10.	U
75-09-2-----	Methylene Chloride	5.	U
67-64-1-----	Acetone	12.	B!
75-15-0-----	Carbon Disulfide	5.	U
75-35-4-----	1,1-Dichloroethene	5.	U
75-34-3-----	1,1-Dichloroethane	5.	U
540-59-0-----	1,2-Dichloroethene (total)	5.	U
67-66-3-----	Chloroform	5.	U
107-02-2-----	1,2-Dichloroethane	5.	U
78-93-3-----	2-Butanone	10.	U
71-55-6-----	1,1,1-Trichloroethane	5.	U
56-23-5-----	Carbon Tetrachloride	5.	U
108-05-4-----	Vinyl Acetate	10.	U
75-27-4-----	Bromodichloromethane	5.	U
78-87-5-----	1,2-Dichloropropane	5.	U
10061-01-5-----	cis-1,3-Dichloropropene	5.	U
79-01-6-----	Trichloroethene	5.	U
124-48-1-----	Dibromochloromethane	5.	U
79-00-5-----	1,1,2-Trichloroethane	5.	U
71-43-2-----	Benzene	5.	U
10061-02-6-----	trans-1,3-Dichloropropene	5.	U
75-25-2-----	Bromoform	5.	U
108-10-1-----	4-Methyl-2-pentanone	10.	U
591-78-6-----	2-Hexanone	10.	U
127-18-4-----	Tetrachloroethene	5.	U
79-34-5-----	1,1,2,2-Tetrachloroethane	5.	U
108-88-3-----	Toluene	83.	!
108-90-7-----	Chlorobenzene	5.	U
100-41-4-----	Ethylbenzene	5.	U
100-42-5-----	Styrene	5.	U
133-02-7-----	Xylene (total)	5.	U



9713508.1864

1E  
VOLATILE ORGANICS ANALYSIS DATA SHEET  
TENTATIVELY IDENTIFIED COMPOUNDS

EPA SAMPLE NO.

92-06727

Lab Name: BATTELLE-PNL

Contract: -----

Lab Code: -----

Case No.: -----

SAS No.: -----

SDG No.: 18

Matrix: (soil/water) SOIL

Lab Sample ID: B06725

Sample wt/vol: 5.143 (g/mL) G

Lab File ID: &gt;PD012

Level: (low/med) LOW

Date Received: 04/29/92

% Moisture: not dec.2.2

Date Analyzed: 4/30/92

Column: CAP

Dilution Factor: 1.00000

Number TICs found: 1

CONCENTRATION UNITS:  
(ug/L or ug/Kg) ug/Kg

CAS NUMBER	COMPOUND NAME	RT	EST. CONC.	Q
1.	Unknowns	29.5-34.	141000.	J
2.				
3.				
4.				
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VOLATILE ORGANIC COMPOUND ANALYSIS REPORTSAMPLE ANALYSIS REPORTED

Analysis of one soil sample for volatile organic compounds by gas chromatography/mass spectrometry (GC/MS) is the subject of this report.

SAMPLE DESCRIPTION

<u>Sample ID</u>	<u>ACL Lab Number</u>	<u>Date received</u>
B06809	92-06904	05/04/92

The sample, B06809, was received on the date specified above in the 325 Building. This sample is referred to as part of SDG #18. Sample 92-06964 (SDG #19) used for QC evaluation (i.e., MS and MSD).

SAMPLE PREPARATION

The preparation and analysis, followed EPA-CLP SOW 2/88 procedures for the analysis of volatile compounds in soils.

ANALYSIS METHOD

- |                          |                               |
|--------------------------|-------------------------------|
| • GC/MS procedure:       | PNL-ALO-335.                  |
| • GC/MS instrumentation: | HP-5890/5970 GC/MS (WB46864). |
| • GC/MS location:        | Lab 327-A, 325 building       |

QUALITY CONTROL

Quality control procedures specified for this method were followed. The quality assurance performance requirements are summarized as follows:

<u>Form</u>	<u>Information</u>	<u>Comments</u>
2B	Surrogate Recovery	Meets all requirements.
3B	MS/MSD Recovery	Meets all requirements.
4A	Method Blank Summary	Meets all requirements.

5A	Tune/Mass Calibration	Meets all requirements.
6A	Initial Calibration	5 point calibration. Meets all requirements.
7A	Daily Calibration	Meets all requirements.
8A	Internal Standards	Meets all requirements.

Lab data are also maintained as follows:

<u>Activity</u>	<u>LRB Number</u>	<u>Page Number</u>
GC/MS injection log	BNW-52907	106-109

## RESULTS

CLP Target Compounds: The attached 1A Forms show that volatile target compound Acetone was observed in the BLANK. However, it was below the Contract Required Quantitation Limit, (CRQL). Acetone was observed, but was below the CRQL, in 92-06964 and 92-06964 DUPE. Toluene was also observed, but below the CRQL in 92-06904.

In summary, no CLP Target Compounds were observed in the sample 92-06904 above the quantitation limits.

The following defines the qualifiers, Q-flags, in the Form 1's:

<u>"Q" Flag</u>	<u>Definition</u>
U	Indicates the compound was analyzed for but not detected, the U-flagged concentration number is the CRQL.
J	Indicates an estimated value for the target or tentatively identified compounds, spectra meet criteria but response is below the CRQL for the target compounds.
B	Compound was found in the blank.
X	Indicates compound was manually deleted because all requirements were not met.



- D                      Analysis was performed on a diluted sample.
- E                      Indicates that Quantitation was outside the calibration range.

Tentatively Identified Compounds: As shown in the attached 1E forms, there were no non-CLP target Compounds in the Blank.

In sample 92-06904 and 92-06904 DUPE, a series of late coeluting Unknowns were observed at the ppm level. The mass spectra of the broad hump indicates the presence of both Alkanes and Alkenes.

1A  
VOLATILE ORGANICS ANALYSIS DATA SHEET

EPA SAMPLE NO.

92-06904

Lab Name: BATTELLE-PNL

Contract: -----

Lab Code: -----

Case No.: -----

SAS No.: -----

SDG No.: 18

Matrix: (soil/water) SOIL

Lab Sample ID: B06809

Sample wt/vol: 4.321 (g/mL) G

Lab File ID: &gt;QA704

Level: (low/med) LOW

Date Received: 05/04/92

% Moisture: not dec.2.2

Date Analyzed: 5/07/92

Column: (pack/cap) CAP

Dilution Factor: 1.00000

CAS NO.	COMPOUND	CONCENTRATION UNITS: (ug/L or ug/Kg) ug/Kg	Q
---------	----------	---	---

74-87-3-----	Chloromethane	12.	U
74-83-9-----	Bromomethane	12.	U
75-01-4-----	Vinyl Chloride	12.	U
75-00-3-----	Chloroethane	12.	U
75-09-2-----	Methylene Chloride	6.	U
67-64-1-----	Acetone	12.	U
75-15-0-----	Carbon Disulfide	6.	U
75-35-4-----	1,1-Dichloroethene	6.	U
75-34-3-----	1,1-Dichloroethane	6.	U
540-59-0-----	1,2-Dichloroethene (total)	6.	U
67-66-3-----	Chloroform	6.	U
107-02-2-----	1,2-Dichloroethane	6.	U
78-93-3-----	2-Butanone	12.	U
71-55-6-----	1,1,1-Trichloroethane	6.	U
56-23-5-----	Carbon Tetrachloride	6.	U
108-05-4-----	Vinyl Acetate	12.	U
75-27-4-----	Bromodichloromethane	6.	U
78-87-5-----	1,2-Dichloropropane	6.	U
10061-01-5-----	cis-1,3-Dichloropropene	6.	U
79-01-6-----	Trichloroethene	6.	U
124-48-1-----	Dibromochloromethane	6.	U
79-00-5-----	1,1,2-Trichloroethane	6.	U
71-43-2-----	Benzene	6.	U
10061-02-6-----	trans-1,3-Dichloropropene	6.	U
75-25-2-----	Bromoform	6.	U
108-10-1-----	4-Methyl-2-pentanone	12.	U
591-78-6-----	2-Hexanone	12.	U
127-18-4-----	Tetrachloroethene	6.	U
79-34-5-----	1,1,2,2-Tetrachloroethane	6.	U
108-88-3-----	Toluene	2.	J
108-90-7-----	Chlorobenzene	6.	U
100-41-4-----	Ethylbenzene	6.	U
100-42-5-----	Styrene	6.	U
133-02-7-----	Xylene (total)	6.	U

1E  
VOLATILE ORGANICS ANALYSIS DATA SHEET  
TENTATIVELY IDENTIFIED COMPOUNDS

EPA SAMPLE NO.

92-06904

Lab Name: BATTELLE-PNL

Contract: -----

Lab Code: -----

Case No.: -----

SAS No.: -----

SDG No.: 18

Matrix: (soil/water) SOIL

Lab Sample ID: B06809

Sample wt/vol: 4.321 (g/mL) G

Lab File ID: &gt;QA704

Level: (low/med) LOW

Date Received: 05/04/92

% Moisture: not dec.2.2

Date Analyzed: 05/07/92

Column: CAP

Dilution Factor: 1.00

Number TICs found: 1

CONCENTRATION UNITS:  
(ug/L or ug/Kg) ug/Kg

CAS NUMBER	COMPOUND NAME	RT	EST. CONC.	Q
1.	Unknowns	29-35	55000.	J
2.				
3.				
4.				
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SEMI-VOLATILE ORGANIC ANALYSISSAMPLE ANALYSIS REPORTED

Analysis of five samples from SDG #18 for semivolatile organic compounds by gas chromatography/mass spectrometry (GC/MS) is the subject of this report.

SAMPLE DESCRIPTION AND PREPARATION

<u>Sample ID</u>	<u>ACL Lab Number</u>
B067Y5	92-06428
B067Y7	92-06713
B067Z3	92-06726
B067Z5	92-06727
B06809	92-06904

The samples were received in good condition. Extractions of both samples and spiked samples were performed.

- |                                      |                             |
|--------------------------------------|-----------------------------|
| • Extraction procedure               | PNL-ALO-344.                |
| • Extraction location                | Lab 302, 325 building       |
| • Extraction type                    | Sonication, low level, soil |
| • Sample/Extract storage temperature | 4°C(+/-2°)                  |

ANALYSIS METHOD

- |                          |                              |
|--------------------------|------------------------------|
| • GC/MS procedure:       | PNL-ALO-345.                 |
| • GC/MS instrumentation: | HP-5890/5970 GC/MS (WD03976) |
| • GC/MS location:        | Lab 325, 325 building.       |

QUALITY CONTROL

The QC features in the analytical procedure were followed, the following summarizes the QC results.

Form	Information	Comments
2D	Surrogate Recovery	All requirements were met. The phenol-d5 recovery was below the required limit in sample B067Z5 (one out of limit recovery is allowed). This sample had a significant matrix effect on all the acid surrogate recoveries.
3D	MS/MSD Recovery	There was a significant matrix effect of sample B067Z5 on all of the acid matrix spike compounds with three of them below the specified lower limits. There was a lesser effect on the base-neutrals with one spike compound below the lower limit. There is no action required for out of limit matrix spike recoveries.
4B	Method Blank Summary	All requirements were met.
5B	Tune/Mass Calibration	All requirements were met.
6B,C	Initial Calibration	All requirements were met.
7B,C	Daily Calibration	All requirements were met.
8B,C	Internal Standards	All requirements were met.

The following comments provide additional information on QC and related features for analysis of these samples.

- Holding time. All requirements were met.
- Surrogate recoveries. In addition to the decreased recoveries for the acid surrogate spikes described above in the Form 2D discussion, the large concentration of tributyl phosphate which elutes at the same time as 2,4,6-tribromophenol, caused the retention

time of the tribromophenol to shift out of the retention time window. The reason for the differences in recoveries of this surrogate in the sample and matrix spiked samples is unknown.

- Method blank.

Di-n-butylphthalate was in the blank above the method quantitation limit, but within acceptable limits.

- GC/MS data, sample report: filed with data in the ACL/ALO records center

## RESULTS

CLP Target Compounds: As seen in the attached 1B,C Forms, target compounds found were phthalates. The phthalates are common contaminants from plastics, and although only the one was found in the blank, it is possible that the other two are also contaminants. Only the concentrations greater than about 330  $\mu\text{g/Kg}$  are above the quantitation limit.

	<u>Concentration, <math>\mu\text{g/Kg}</math></u>					
	<u>B067Y5</u>	<u>B067Y7</u>	<u>B067Z3</u>	<u>B067Z5</u>	<u>B06809</u>	<u>Blank</u>
Di-n-butylphthalate	360	12	260	340	470	450/230
Bis(2-ethylhexyl)phthalate	72	31	41	100	110	---
Di-n-octylphthalate	12	56	---	24	38	---

Tentatively Identified Compounds (TIC): The attached 1F Forms show results for the TIC's. Concentration estimates for the TIC's are made assuming that the response factor for each TIC is one. The peak area for each TIC is then compared to the area of the nearest internal standard (for which concentrations are known) to estimate the TIC concentrations. Identification of the TIC is made by a computer search of the NIST mass spectral library to attempt a match with the spectrum of each of the TIC's. The TIC's reported as



"Unknown" did not have satisfactory matches with library spectra. The TIC concentration estimate and identification are reported only if the TIC peak area is 10% or greater than the nearest internal standard peak area.

Sample B067Y5 contains a relatively large number of TIC's, all at low concentrations. Most of the compounds are solvent, or degraded solvent, constituents; and as for many of the 200-BP-1 samples, tributyl phosphate was found.

Samples B067Y7 and B067Z3 contain fewer TIC's, and these are at relatively low concentrations. Tributyl phosphate is in both samples, and a few solvent constituents and a phosphonate ester are in B067Y7.

Sample B067Z5 has a large number of TIC's at relatively high concentrations. There are about a dozen other TIC's at lower concentrations than the 30 reported on the form 1F for this sample that are not included in this report (the method requirement is that up to 20 TIC's are to be reported). Most of the TIC's are solvent, or degraded solvent, constituents. Tributyl phosphate is also present at a relatively high concentration.

Sample B06809 is similar to B067Z5 in TIC content, but at slightly lower concentrations.

The following defines the Q-flags in the Form 1's

<u>"Q" Flag</u>	<u>Definition</u>
U	Indicates the compound was analyzed for but not detected, the U-flagged concentration is the Contract Required Quantitation Limit.
J	Indicates an estimated value for target and tentatively identified compounds, spectra meet criteria but response is below Contract Required Quantitation Limit for the target compounds.
B	Indicates compound was found in the blank.

- X Indicates compound was manually deleted because all requirements were not met.
- D Indicates analysis was performed on a diluted sample.
- E Indicates that quantitation was outside of the calibration range.
- A Aldol condensation product.

1B  
SEMIVOLATILE ORGANICS ANALYSIS DATA SHEET

EPA SAMPLE NO.

B067Y5

Lab Name: BATTELLE-PNL

Contract: -----

Lab Code: ----- Case No.: ----- SAS No.: ----- SDG No.: 18

Matrix: (soil/water) SOIL

Lab Sample ID: 92-06428-E1

Sample wt/vol: 30.16 (g/mL) G

Lab File ID: &gt;E1504

Level: (low/med) LOW

Date Received: 04/21/92

% Moisture: not dec.3.08 dec. --

Date Extracted: 04/30/92

Extraction: (Sepf/Cont/Sonc) SONC

Date Analyzed: 5/15/92

GPC Cleanup: (Y/N) N pH: 8.0

Dilution Factor: 1.00000

CONCENTRATION UNITS:  
CAS NO. COMPOUND (ug/L or ug/Kg) ug/Kg Q

108-95-2-----	Phenol	340.	U
111-44-4-----	bis(2-Chloroethyl) Ether	340.	U
95-57-8-----	2-Chlorophenol	340.	U
541-73-1-----	1,3-Dichlorobenzene	340.	U
106-46-7-----	1,4-Dichlorobenzene	340.	U
100-51-6-----	Benzyl alcohol	340.	U
95-50-1-----	1,2-Dichlorobenzene	340.	U
95-48-7-----	2-Methylphenol	340.	U
39638-32-9-----	bis(2-chloroisopropyl) ether	340.	U
106-44-5-----	4-Methylphenol	340.	U
621-64-7-----	N-Nitroso-Di-n-propylamine	340.	U
67-72-1-----	Hexachloroethane	340.	U
98-95-3-----	Nitrobenzene	340.	U
78-59-1-----	Isophorone	340.	U
88-75-5-----	2-Nitrophenol	340.	U
105-67-9-----	2,4-Dimethylphenol	340.	U
65-85-0-----	Benzoic acid	1700.	U
111-91-1-----	bis(2-Chloroethoxy) methane	340.	U
120-83-2-----	2,4-Dichlorophenol	340.	U
120-82-1-----	1,2,4-Trichlorobenzene	340.	U
91-20-3-----	Naphthalene	340.	U
106-47-8-----	4-Chloroaniline	340.	U
87-68-3-----	Hexachlorobutadiene	340.	U
59-50-7-----	4-Chloro-3-methylphenol	340.	U
91-57-6-----	2-Methylnaphthalene	340.	U
77-47-4-----	Hexachlorocyclopentadiene	340.	U
88-06-2-----	2,4,6-Trichlorophenol	340.	U
95-95-4-----	2,4,5-Trichlorophenol	1700.	U
91-58-7-----	2-Chloronaphthalene	340.	U
88-74-4-----	2-Nitroaniline	1700.	U
131-11-3-----	Dimethylphthalate	340.	U
208-96-8-----	Acenaphthylene	340.	U
606-20-2-----	2,6-Dinitrotoluene	340.	U



1C  
SEMIVOLATILE ORGANICS ANALYSIS DATA SHEET

EPA SAMPLE NO.

B067Y5

Lab Name: BATTELLE-PNL

Contract: -----

Lab Code: ----- Case No.: ----- SAS No.: ----- SDG No.: 18

Matrix: (soil/water) SOIL

Lab Sample ID: 92-06428-E1

Sample wt/vol: 30.16 (g/mL) G

Lab File ID: &gt;E1504

Level: (low/med) LOW

Date Received: 04/21/92

% Moisture: not dec. 3.08 dec. --

Date Extracted: 04/30/92

Extraction: (Sepf/Cont/Sonc) SONC

Date Analyzed: 5/15/92

GPC Cleanup: (Y/N) N pH: 8.0

Dilution Factor: 1.00000

CONCENTRATION UNITS:  
(ug/L or ug/Kg) ug/Kg

CAS NO.	COMPOUND	CONCENTRATION UNITS: (ug/L or ug/Kg) ug/Kg	Q
99-09-2-----	3-Nitroaniline	1700.	U
83-32-9-----	Acenaphthene	340.	U
51-28-5-----	2,4-Dinitrophenol	1700.	U
100-02-7-----	4-Nitrophenol	1700.	U
132-64-9-----	Dibenzofuran	340.	U
121-14-2-----	2,4-Dinitrotoluene	340.	U
84-66-2-----	Diethylphthalate	340.	U
7005-72-3-----	4-Chlorophenyl-phenylether	340.	U
86-73-7-----	Fluorene	340.	U
100-01-6-----	4-Nitroaniline	1700.	U
534-52-1-----	4,6-Dinitro-2-methylphenol	1700.	U
86-30-6-----	N-Nitrosodiphenylamine (1)	340.	U
101-55-3-----	4-Bromophenyl-phenylether	340.	U
118-74-1-----	Hexachlorobenzene	340.	U
87-86-5-----	Pentachlorophenol	1700.	U
85-01-8-----	Phenanthrene	340.	U
120-12-7-----	Anthracene	340.	U
84-74-2-----	Di-n-butylphthalate	360.	B
206-44-0-----	Fluoranthene	340.	U
129-00-0-----	Pyrene	340.	U
85-68-7-----	Butylbenzylphthalate	340.	U
91-94-1-----	3,3'-Dichlorobenzidine	680.	U
56-55-3-----	Benzo(a)anthracene	340.	U
218-01-9-----	Chrysene	340.	U
117-81-7-----	bis(2-Ethylhexyl)phthalate	72.	J
117-84-0-----	Di-n-octylphthalate	12.	J
205-99-2-----	Benzo(b)fluoranthene	340.	U
207-08-9-----	Benzo(k)fluoranthene	340.	U
50-32-8-----	Benzo(a)pyrene	340.	U
193-39-5-----	Indeno(1,2,3-cd)pyrene	340.	U
53-70-3-----	Dibenz(a,h)anthracene	340.	U
191-24-2-----	Benzo(g,h,i)perylene	340.	U

(1) - Cannot be separated from Diphenylamine

1F  
SEMIVOLATILE ORGANICS ANALYSIS DATA SHEET  
TENTATIVELY IDENTIFIED COMPOUNDS

EPA SAMPLE NO.

B067Y5

Lab Name: BATTELLE-PNL

Contract: -----

Lab Code: -----

Case No.: -----

SAS No.: -----

SDG No.: 18

Matrix: (soil/water) SOIL

Lab Sample ID: 92-06428-E1

Sample wt/vol: 30.16 (g/mL) G

Lab File ID: &gt;E1504

Level: (low/med) LOW

Date Received: 04/21/92

% Moisture: not dec.3.08 dec. --

Date Extracted: 04/30/92

Extraction: (Sepf/Cont/Sonc) SONC

Date Analyzed: 5/15/92

GPC Cleanup: (Y/N) N pH: 8.0

Dilution Factor: 1.00000

Number TICs found: 27

CONCENTRATION UNITS:  
(ug/L or ug/Kg) ug/Kg

CAS NUMBER	COMPOUND NAME	RT	EST. CONC.	Q
1.	Unknown	4.62	150.	J
2.	Unknown	4.70	770.	JAB
3.	Unknown	5.00	420.	JAB
4.	112403 Dodecane	9.02	160.	JA
5.	Unknown alkane	9.33	150.	J
6.	Unknown cycloalkane	9.65	330.	J
7.	Unknown alkane	10.65	310.	J
8.	Unknown alkene	10.93	530.	J
9.	629505 Tridecane	11.29	300.	J
10.	Unknown cycloalkane	11.39	160.	J
11.	Unknown cycloalkane	11.72	190.	J
12.	Unknown siloxane	11.96	210.	J
13.	Unknown cycloalkane	12.10	140.	J
14.	Unknown cycloalkane	12.47	300.	J
15.	Unknown cycloalkane	12.83	170.	J
16.	Unknown alkane	13.22	590.	J
17.	Unknown cycloalkane	13.57	610.	J
18.	Unknown alkane	13.80	440.	J
19.	Unknown alkane	15.41	480.	J
20.	Unknown	15.62	180.	J
21.	Unknown alkene	15.83	350.	J
22.	Unknown alkane	16.39	200.	J
23.	126738 Phosphoric acid tributyl est	20.20	200.	J
24.	Unknown aromatic	21.58	200.	J
25.	Unknown alkane	29.75	150.	J
26.	Unknown alkane	31.17	240.	J
27.	Unknown alkane	32.48	200.	J
28.				
29.				
30.				



1B  
SEMIVOLATILE ORGANICS ANALYSIS DATA SHEET

EPA SAMPLE NO.

Lab Name: BATTELLE-PNL

Contract: -----

B067Y7

Lab Code: ----- Case No.: ----- SAS No.: ----- SDG No.: 18

Matrix: (soil/water) SOIL

Lab Sample ID: 92-06713-E1

Sample wt/vol: 30.73 (g/mL) G

Lab File ID: &gt;E1505

Level: (low/med) LOW

Date Received: 04/27/92

% Moisture: not dec.2.57 dec. --

Date Extracted: 04/30/92

Extraction: (Sepf/Cont/Sonc) SONC

Date Analyzed: 5/15/92

GPC Cleanup: (Y/N) N pH: 9.0

Dilution Factor: 1.00000

CONCENTRATION UNITS:  
(ug/L or ug/Kg) ug/Kg Q

CAS NO.	COMPOUND	CONCENTRATION UNITS: (ug/L or ug/Kg) ug/Kg	Q
108-95-2-----	Phenol	330.	U
111-44-4-----	bis(2-Chloroethyl) Ether	330.	U
95-57-8-----	2-Chlorophenol	330.	U
541-73-1-----	1,3-Dichlorobenzene	330.	U
106-46-7-----	1,4-Dichlorobenzene	330.	U
100-51-6-----	Benzyl alcohol	330.	U
95-50-1-----	1,2-Dichlorobenzene	330.	U
95-48-7-----	2-Methylphenol	330.	U
39638-32-9-----	bis(2-chloroisopropyl) ether	330.	U
106-44-5-----	4-Methylphenol	330.	U
621-64-7-----	N-Nitroso-Di-n-propylamine	330.	U
67-72-1-----	Hexachloroethane	330.	U
98-95-3-----	Nitrobenzene	330.	U
78-59-1-----	Isophorone	330.	U
88-75-5-----	2-Nitrophenol	330.	U
105-67-9-----	2,4-Dimethylphenol	330.	U
65-85-0-----	Benzoic acid	1700.	U
111-91-1-----	bis(2-Chloroethoxy) methane	330.	U
120-83-2-----	2,4-Dichlorophenol	330.	U
120-82-1-----	1,2,4-Trichlorobenzene	330.	U
91-20-3-----	Naphthalene	330.	U
106-47-8-----	4-Chloroaniline	330.	U
87-68-3-----	Hexachlorobutadiene	330.	U
59-50-7-----	4-Chloro-3-methylphenol	330.	U
91-57-6-----	2-Methylnaphthalene	330.	U
77-47-4-----	Hexachlorocyclopentadiene	330.	U
88-06-2-----	2,4,6-Trichlorophenol	330.	U
95-95-4-----	2,4,5-Trichlorophenol	1700.	U
91-58-7-----	2-Chloronaphthalene	330.	U
88-74-4-----	2-Nitroaniline	1700.	U
131-11-3-----	Dimethylphthalate	330.	U
208-96-8-----	Acenaphthylene	330.	U
606-20-2-----	2,6-Dinitrotoluene	330.	U



1C  
SEMIVOLATILE ORGANICS ANALYSIS DATA SHEET

EPA SAMPLE NO.

B067Y7

Lab Name: BATTELLE-PNL

Contract: -----

Lab Code: ----- Case No.: ----- SAS No.: ----- SDG No.: 18

Matrix: (soil/water) SOIL

Lab Sample ID: 92-06713-E1

Sample wt/vol: 30.73 (g/mL) G

Lab File ID: &gt;E1505

Level: (low/med) LOW

Date Received: 04/27/92

% Moisture: not dec. 2.57 dec. --

Date Extracted: 04/30/92

Extraction: (Sepf/Cont/Sonc) SONC

Date Analyzed: 5/15/92

GPC Cleanup: (Y/N) N pH: 9.0

Dilution Factor: 1.00000

CONCENTRATION UNITS:  
(ug/L or ug/Kg) ug/Kg Q

CAS NO.	COMPOUND	CONCENTRATION UNITS: (ug/L or ug/Kg) ug/Kg	Q
99-09-2-----	3-Nitroaniline	1700.	U
83-32-9-----	Acenaphthene	330.	U
51-28-5-----	2,4-Dinitrophenol	1700.	U
100-02-7-----	4-Nitrophenol	1700.	U
132-64-9-----	Dibenzofuran	330.	U
121-14-2-----	2,4-Dinitrotoluene	330.	U
84-66-2-----	Diethylphthalate	330.	U
7005-72-3-----	4-Chlorophenyl-phenylether	330.	U
86-73-7-----	Fluorene	330.	U
100-01-6-----	4-Nitroaniline	1700.	U
534-52-1-----	4,6-Dinitro-2-methylphenol	1700.	U
86-30-6-----	N-Nitrosodiphenylamine (1)	330.	U
101-55-3-----	4-Bromophenyl-phenylether	330.	U
118-74-1-----	Hexachlorobenzene	330.	U
87-86-5-----	Pentachlorophenol	1700.	U
85-01-8-----	Phenanthrene	330.	U
120-12-7-----	Anthracene	330.	U
84-74-2-----	Di-n-butylphthalate	12.	JB
206-44-0-----	Fluoranthene	330.	U
129-00-0-----	Pyrene	330.	U
85-68-7-----	Butylbenzylphthalate	330.	U
91-94-1-----	3,3'-Dichlorobenzidine	670.	U
56-55-3-----	Benzo(a)anthracene	330.	U
218-01-9-----	Chrysene	330.	U
117-81-7-----	bis(2-Ethylhexyl)phthalate	31.	J
117-84-0-----	Di-n-octylphthalate	56.	J
205-99-2-----	Benzo(b)fluoranthene	330.	U
207-08-9-----	Benzo(k)fluoranthene	330.	U
50-32-8-----	Benzo(a)pyrene	330.	U
193-39-5-----	Indeno(1,2,3-cd)pyrene	330.	U
53-70-3-----	Dibenz(a,h)anthracene	330.	U
191-24-2-----	Benzo(g,h,i)perylene	330.	U

(1) - Cannot be separated from Diphenylamine

1F  
SEMIVOLATILE ORGANICS ANALYSIS DATA SHEET  
TENTATIVELY IDENTIFIED COMPOUNDS

EPA SAMPLE NO.

B067Y7

Lab Name: BATTELLE-PNL

Contract: -----

Lab Code: ----- Case No.: ----- SAS No.: ----- SDG No.: 18

Matrix: (soil/water) SOIL

Lab Sample ID: 92-06713-E1

Sample wt/vol: 30.73 (g/mL) G

Lab File ID: &gt;E1505

Level: (low/med) LOW

Date Received: 04/27/92

% Moisture: not dec. 2.57 dec. --

Date Extracted: 04/30/92

Extraction: (Sepf/Cont/Sonc) SONC

Date Analyzed: 5/15/92

GPC Cleanup: (Y/N) N pH: 9.0

Dilution Factor: 1.00000

Number TICs found: 7

CONCENTRATION UNITS:  
(ug/L or ug/Kg) ug/Kg

CAS NUMBER	COMPOUND NAME	RT	EST. CONC.	Q
1.	Unknown	4.70	690.	JAB
2.	Unknown	4.99	190.	JAB
3. 126738	Phosphoric acid tributyl est	20.20	160.	J
4.	Unknown alkane	28.12	250.	J
5.	Unknown alkane	29.76	530.	J
6.	Unknown alkane	31.18	410.	J
7.	Unknown phosphonate ester	34.71	280.	J
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1B  
SEMIVOLATILE ORGANICS ANALYSIS DATA SHEET

EPA SAMPLE NO.

B067Z3

Lab Name: BATTELLE-PNL

Contract: -----

Lab Code: ----- Case No.: ----- SAS No.: ----- SDG No.: 18

Matrix: (soil/water) SOIL

Lab Sample ID: 92-06726-E1

Sample wt/vol: 30.49 (g/mL) G

Lab File ID: &gt;E1506

Level: (low/med) LOW

Date Received: 04/29/92

% Moisture: not dec. 3.35 dec. --

Date Extracted: 04/30/92

Extraction: (Sepf/Cont/Sonc) SONC

Date Analyzed: 5/15/92

GPC Cleanup: (Y/N) N pH: 9.0

Dilution Factor: 1.00000

CONCENTRATION UNITS:  
CAS NO. COMPOUND (ug/L or ug/Kg) ug/Kg Q

108-95-2-----	Phenol	340.	U
111-44-4-----	bis(2-Chloroethyl) Ether	340.	U
95-57-8-----	2-Chlorophenol	340.	U
541-73-1-----	1,3-Dichlorobenzene	340.	U
106-46-7-----	1,4-Dichlorobenzene	340.	U
100-51-6-----	Benzyl alcohol	340.	U
95-50-1-----	1,2-Dichlorobenzene	340.	U
95-48-7-----	2-Methylphenol	340.	U
39638-32-9-----	bis(2-chloroisopropyl) ether	340.	U
106-44-5-----	4-Methylphenol	340.	U
621-64-7-----	N-Nitroso-Di-n-propylamine	340.	U
67-72-1-----	Hexachloroethane	340.	U
98-95-3-----	Nitrobenzene	340.	U
78-59-1-----	Isophorone	340.	U
88-75-5-----	2-Nitrophenol	340.	U
105-67-9-----	2,4-Dimethylphenol	340.	U
65-85-0-----	Benzoic acid	1700.	U
111-91-1-----	bis(2-Chloroethoxy) methane	340.	U
120-83-2-----	2,4-Dichlorophenol	340.	U
120-82-1-----	1,2,4-Trichlorobenzene	340.	U
91-20-3-----	Naphthalene	340.	U
106-47-8-----	4-Chloroaniline	340.	U
87-68-3-----	Hexachlorobutadiene	340.	U
59-50-7-----	4-Chloro-3-methylphenol	340.	U
91-57-6-----	2-Methylnaphthalene	340.	U
77-47-4-----	Hexachlorocyclopentadiene	340.	U
88-06-2-----	2,4,6-Trichlorophenol	340.	U
95-95-4-----	2,4,5-Trichlorophenol	1700.	U
91-58-7-----	2-Chloronaphthalene	340.	U
88-74-4-----	2-Nitroaniline	1700.	U
131-11-3-----	Dimethylphthalate	340.	U
208-96-8-----	Acenaphthylene	340.	U
606-20-2-----	2,6-Dinitrotoluene	340.	U



1C  
SEMIVOLATILE ORGANICS ANALYSIS DATA SHEET

EPA SAMPLE NO.

Lab Name: BATTELLE-PNL

Contract: -----

B067Z3

Lab Code: ----- Case No.: ----- SAS No.: ----- SDG No.: 18

Matrix: (soil/water) SOIL

Lab Sample ID: 92-06726-E1

Sample wt/vol: 30.49 (g/mL) G

Lab File ID: &gt;E1506

Level: (low/med) LOW

Date Received: 04/29/92

% Moisture: not dec.3.35 dec. --

Date Extracted: 04/30/92

Extraction: (Sepf/Cont/Sonc) SONC

Date Analyzed: 5/15/92

GPC Cleanup: (Y/N) N pH: 9.0

Dilution Factor: 1.00000

CAS NO.	COMPOUND	CONCENTRATION UNITS: (ug/L or ug/Kg) ug/Kg	Q
99-09-2-----	3-Nitroaniline	1700.	U
83-32-9-----	Acenaphthene	340.	U
51-28-5-----	2,4-Dinitrophenol	1700.	U
100-02-7-----	4-Nitrophenol	1700.	U
132-64-9-----	Dibenzofuran	340.	U
121-14-2-----	2,4-Dinitrotoluene	340.	U
84-66-2-----	Diethylphthalate	340.	U
7005-72-3-----	4-Chlorophenyl-phenylether	340.	U
86-73-7-----	Fluorene	340.	U
100-01-6-----	4-Nitroaniline	1700.	U
534-52-1-----	4,6-Dinitro-2-methylphenol	1700.	U
86-30-6-----	N-Nitrosodiphenylamine (1)	340.	U
101-55-3-----	4-Bromophenyl-phenylether	340.	U
118-74-1-----	Hexachlorobenzene	340.	U
87-86-5-----	Pentachlorophenol	1700.	U
85-01-8-----	Phenanthrene	340.	U
120-12-7-----	Anthracene	340.	U
84-74-2-----	Di-n-butylphthalate	260.	JB
206-44-0-----	Fluoranthene	340.	U
129-00-0-----	Pyrene	340.	U
85-68-7-----	Butylbenzylphthalate	340.	U
91-94-1-----	3,3'-Dichlorobenzidine	680.	U
56-55-3-----	Benzo(a)anthracene	340.	U
218-01-9-----	Chrysene	340.	U
117-81-7-----	bis(2-Ethylhexyl)phthalate	41.	J
117-84-0-----	Di-n-octylphthalate	340.	U
205-99-2-----	Benzo(b)fluoranthene	340.	U
207-08-9-----	Benzo(k)fluoranthene	340.	U
50-32-8-----	Benzo(a)pyrene	340.	U
193-39-5-----	Indeno(1,2,3-cd)pyrene	340.	U
53-70-3-----	Dibenz(a,h)anthracene	340.	U
191-24-2-----	Benzo(g,h,i)perylene	340.	U

(1) - Cannot be separated from Diphenylamine

1F  
SEMIVOLATILE ORGANICS ANALYSIS DATA SHEET  
TENTATIVELY IDENTIFIED COMPOUNDS

EPA SAMPLE NO.

B067Z3

Lab Name: BATTELLE-PNL

Contract: -----

Lab Code: -----

Case No.: -----

SAS No.: -----

SDG No.: 18

Matrix: (soil/water) SOIL

Lab Sample ID: 92-06726-E1

Sample wt/vol: 30.49 (g/mL) G

Lab File ID: &gt;E1506

Level: (low/med) LOW

Date Received: 04/29/92

% Moisture: not dec. 3.35 dec. --

Date Extracted: 04/30/92

Extraction: (Sepf/Cont/Sonc) SONC

Date Analyzed: 5/15/92

GPC Cleanup: (Y/N) N pH: 9.0

Dilution Factor: 1.00000

Number TICs found: 3

CONCENTRATION UNITS:  
(ug/L or ug/Kg) ug/Kg

CAS NUMBER	COMPOUND NAME	RT	EST. CONC.	Q
1.	Unknown	4.70	900.	JAB
2. 126738	Phosphoric acid tributyl est	20.25	2800.	J
3.	Unknown	37.64	260.	J
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1B  
SEMIVOLATILE ORGANICS ANALYSIS DATA SHEET

EPA SAMPLE NO.

Lab Name: BATTELLE-PNL

Contract: -----

B067Z5

Lab Code: ----- Case No.: ----- SAS No.: ----- SDG No.: 18

Matrix: (soil/water) SOIL

Lab Sample ID: 92-06727-E1

Sample wt/vol: 30.76 (g/mL) G

Lab File ID: &gt;E1507

Level: (low/med) LOW

Date Received: 04/29/92

% Moisture: not dec.2.20 dec. --

Date Extracted: 04/30/92

Extraction: (Sepf/Cont/Sonc) SONC

Date Analyzed: 5/15/92

GPC Cleanup: (Y/N) N pH: 10.2

Dilution Factor: 1.00000

CONCENTRATION UNITS:  
CAS NO. COMPOUND (ug/L or ug/Kg) ug/Kg Q

108-95-2-----	Phenol	330.	U
111-44-4-----	bis(2-Chloroethyl) Ether	330.	U
95-57-8-----	2-Chlorophenol	330.	U
541-73-1-----	1,3-Dichlorobenzene	330.	U
106-46-7-----	1,4-Dichlorobenzene	330.	U
100-51-6-----	Benzyl alcohol	330.	U
95-50-1-----	1,2-Dichlorobenzene	330.	U
95-48-7-----	2-Methylphenol	330.	U
39638-32-9-----	bis(2-chloroisopropyl) ether	330.	U
106-44-5-----	4-Methylphenol	330.	U
621-64-7-----	N-Nitroso-Di-n-propylamine	330.	U
67-72-1-----	Hexachloroethane	330.	U
98-95-3-----	Nitrobenzene	330.	U
78-59-1-----	Isophorone	190.	J
88-75-5-----	2-Nitrophenol	330.	U
105-67-9-----	2,4-Dimethylphenol	330.	U
65-85-0-----	Benzoic acid	1700.	U
111-91-1-----	bis(2-Chloroethoxy) methane	330.	U
120-83-2-----	2,4-Dichlorophenol	330.	U
120-82-1-----	1,2,4-Trichlorobenzene	330.	U
91-20-3-----	Naphthalene	330.	U
106-47-8-----	4-Chloroaniline	330.	U
87-68-3-----	Hexachlorobutadiene	330.	U
59-50-7-----	4-Chloro-3-methylphenol	330.	U
91-57-6-----	2-Methylnaphthalene	330.	U
77-47-4-----	Hexachlorocyclopentadiene	330.	U
88-06-2-----	2,4,6-Trichlorophenol	330.	U
95-95-4-----	2,4,5-Trichlorophenol	1700.	U
91-58-7-----	2-Chloronaphthalene	330.	U
88-74-4-----	2-Nitroaniline	1700.	U
131-11-3-----	Dimethylphthalate	330.	U
208-96-8-----	Acenaphthylene	330.	U
606-20-2-----	2,6-Dinitrotoluene	330.	U



1C  
SEMIVOLATILE ORGANICS ANALYSIS DATA SHEET

EPA SAMPLE NO.

B06725

Lab Name: BATTELLE-PNL

Contract: -----

Lab Code: ----- Case No.: ----- SAS No.: ----- SDG No.: 18

Matrix: (soil/water) SOIL

Lab Sample ID: 92-06727-E1

Sample wt/vol: 30.76 (g/mL) G

Lab File ID: &gt;E1507

Level: (low/med) LOW

Date Received: 04/29/92

% Moisture: not dec.2.20 dec. --

Date Extracted: 04/30/92

Extraction: (Sepf/Cont/Sonc) SONC

Date Analyzed: 5/15/92

GPC Cleanup: (Y/N) N pH: 10.2

Dilution Factor: 1.00000

CONCENTRATION UNITS:  
(ug/L or ug/Kg) ug/Kg Q

CAS NO.	COMPOUND	CONCENTRATION UNITS: (ug/L or ug/Kg) ug/Kg	Q
99-09-2-----	3-Nitroaniline	1700.	U
83-32-9-----	Acenaphthene	330.	U
51-28-5-----	2,4-Dinitrophenol	1700.	U
100-02-7-----	4-Nitrophenol	1700.	U
132-64-9-----	Dibenzofuran	330.	U
121-14-2-----	2,4-Dinitrotoluene	330.	U
84-66-2-----	Diethylphthalate	330.	U
7005-72-3-----	4-Chlorophenyl-phenylether	330.	U
86-73-7-----	Fluorene	330.	U
100-01-6-----	4-Nitroaniline	1700.	U
534-52-1-----	4,6-Dinitro-2-methylphenol	1700.	U
86-30-6-----	N-Nitrosodiphenylamine (1)	330.	U
101-55-3-----	4-Bromophenyl-phenylether	330.	U
118-74-1-----	Hexachlorobenzene	330.	U
87-86-5-----	Pentachlorophenol	1700.	U
85-01-8-----	Phenanthrene	330.	U
120-12-7-----	Anthracene	330.	U
84-74-2-----	Di-n-butylphthalate	340.	B
206-44-0-----	Fluoranthene	330.	U
129-00-0-----	Pyrene	330.	U
85-68-7-----	Butylbenzylphthalate	330.	U
91-94-1-----	3,3'-Dichlorobenzidine	660.	U
56-55-3-----	Benzo(a)anthracene	330.	U
218-01-9-----	Chrysene	330.	U
117-81-7-----	bis(2-Ethylhexyl)phthalate	100.	J
117-84-0-----	Di-n-octylphthalate	24.	J
205-99-2-----	Benzo(b)fluoranthene	330.	U
207-08-9-----	Benzo(k)fluoranthene	330.	U
50-32-8-----	Benzo(a)pyrene	330.	U
193-39-5-----	Indeno(1,2,3-cd)pyrene	330.	U
53-70-3-----	Dibenz(a,h)anthracene	330.	U
191-24-2-----	Benzo(g,h,i)perylene	330.	U

(1) - Cannot be separated from Diphenylamine

1F  
SEMIVOLATILE ORGANICS ANALYSIS DATA SHEET  
TENTATIVELY IDENTIFIED COMPOUNDS

EPA SAMPLE NO.

B067Z5

Lab Name: BATTELLE-PNL

Contract: -----

Lab Code: -----

Case No.: -----

SAS No.: -----

SDG No.: 18

Matrix: (soil/water) SOIL

Lab Sample ID: 92-06727-E1

Sample wt/vol: 30.76 (g/mL) G

Lab File ID: &gt;E1507

Level: (low/med) LOW

Date Received: 04/29/92

% Moisture: not dec.2.20 dec. --

Date Extracted: 04/30/92

Extraction: (Sepf/Cont/Sonc) SONC

Date Analyzed: 5/15/92

GPC Cleanup: (Y/N) N pH:10.2

Dilution Factor: 1.00000

Number TICs found: 30

CONCENTRATION UNITS:  
(ug/L or ug/Kg) ug/Kg

CAS NUMBER	COMPOUND NAME	RT	EST. CONC.	Q
1.	Unknown	4.83	1100.	J
2.	Unknown alkane	7.12	1800.	J
3.	Unknown	8.12	390.	J
4.	Unknown alkane	8.30	540.	J
5.	Unknown	9.14	2600.	J
6.	Unknown alkane	9.43	4800.	J
7.	Unknown cycloalkane	9.72	910.	J
8.	Unknown cycloalkane	10.07	1600.	J
9.	Unknown	10.28	670.	J
10.	Unknown alkane	10.53	1300.	J
11.	Unknown alkane	10.84	6800.	J
12.	Unknown alkene	11.20	510.	J
13.	Unknown alkane	11.55	8900.	J
14.	Unknown alkane	11.90	1400.	J
15.	Unknown cycloalkane	12.58	3800.	J
16.	Unknown alkane	13.47	7500.	J
17.	Unknown alkane	14.11	18000.	J
18.	Unknown alkane	14.23	960.	J
19.	Unknown cycloalkane	15.21	3700.	J
20.	Unknown alkane	15.66	13000.	J
21.	Unknown alkane	15.79	1800.	J
22.	Unknown alkane	16.63	13000.	J
23.	Unknown alkane	17.72	900.	J
24.	Unknown alkane	17.88	1900.	J
25.	Unknown alkane	18.09	630.	J
26.	Unknown alkane	19.06	3900.	J
27.	126738 Phosphoric acid tributyl est	20.53	94000.	J
28.	Unknown alkane	21.73	990.	J
29.	Unknown alkane	21.86	870.	J
30.	Unknown	26.44	710.	J



1B  
SEMIVOLATILE ORGANICS ANALYSIS DATA SHEET

EPA SAMPLE NO.

B06809

Lab Name: BATTELLE-PNL

Contract: -----

Lab Code: -----

Case No.: -----

SAS No.: -----

SDG No.: 18

Matrix: (soil/water) SOIL

Lab Sample ID: 92-06904-E1

Sample wt/vol: 30.265 (g/mL) G

Lab File ID: &gt;F0409

Level: (low/med) LOW

Date Received: 05/04/92

% Moisture: not dec.2.23 dec. --

Date Extracted: 05/12/92

Extraction: (Sepf/Cont/Sonc) SONC

Date Analyzed: 6/04/92

GPC Cleanup: (Y/N) N pH: 8.5

Dilution Factor: 1.00000

CONCENTRATION UNITS:  
CAS NO. COMPOUND (ug/L or ug/Kg) ug/Kg Q

108-95-2-----	Phenol	340.	U
111-44-4-----	bis(2-Chloroethyl) Ether	340.	U
95-57-8-----	2-Chlorophenol	340.	U
541-73-1-----	1,3-Dichlorobenzene	340.	U
106-46-7-----	1,4-Dichlorobenzene	340.	U
100-51-6-----	Benzyl alcohol	340.	U
95-50-1-----	1,2-Dichlorobenzene	340.	U
95-48-7-----	2-Methylphenol	340.	U
39638-32-9-----	bis(2-chloroisopropyl) ether	340.	U
106-44-5-----	4-Methylphenol	340.	U
621-64-7-----	N-Nitroso-Di-n-propylamine	340.	U
67-72-1-----	Hexachloroethane	340.	U
98-95-3-----	Nitrobenzene	340.	U
78-59-1-----	Isophorone	340.	U
88-75-5-----	2-Nitrophenol	340.	U
105-67-9-----	2,4-Dimethylphenol	340.	U
65-85-0-----	Benzoic acid	1700.	U
111-91-1-----	bis(2-Chloroethoxy) methane	340.	U
120-83-2-----	2,4-Dichlorophenol	340.	U
120-82-1-----	1,2,4-Trichlorobenzene	340.	U
91-20-3-----	Naphthalene	340.	U
106-47-8-----	4-Chloroaniline	340.	U
87-68-3-----	Hexachlorobutadiene	340.	U
59-50-7-----	4-Chloro-3-methylphenol	340.	U
91-57-6-----	2-Methylnaphthalene	340.	U
77-47-4-----	Hexachlorocyclopentadiene	340.	U
88-06-2-----	2,4,6-Trichlorophenol	340.	U
95-95-4-----	2,4,5-Trichlorophenol	1700.	U
91-58-7-----	2-Chloronaphthalene	340.	U
88-74-4-----	2-Nitroaniline	1700.	U
131-11-3-----	Dimethylphthalate	340.	U
208-96-8-----	Acenaphthylene	340.	U
606-20-2-----	2,6-Dinitrotoluene	340.	U



1C  
SEMIVOLATILE ORGANICS ANALYSIS DATA SHEET

EPA SAMPLE NO.

B06809

Lab Name: BATTELLE-PNL

Contract: -----

Lab Code: ----- Case No.: ----- SAS No.: ----- SDG No.: 18

Matrix: (soil/water) SOIL

Lab Sample ID: 92-06904-E1

Sample wt/vol: 30.265 (g/mL) G

Lab File ID: &gt;F0409

Level: (low/med) LOW

Date Received: 05/04/92

% Moisture: not dec. 2.23 dec. --

Date Extracted: 05/12/92

Extraction: (Sepf/Cont/Sonc) SONC

Date Analyzed: 6/04/92

GPC Cleanup: (Y/N) N pH: 8.5

Dilution Factor: 1.00000

CONCENTRATION UNITS:  
(ug/L or ug/Kg) ug/Kg Q

CAS NO.	COMPOUND	CONCENTRATION UNITS: (ug/L or ug/Kg) ug/Kg	Q
99-09-2-----	3-Nitroaniline	1700.	U
83-32-9-----	Acenaphthene	340.	U
51-28-5-----	2,4-Dinitrophenol	1700.	U
100-02-7-----	4-Nitrophenol	1700.	U
132-64-9-----	Dibenzofuran	340.	U
121-14-2-----	2,4-Dinitrotoluene	340.	U
84-66-2-----	Diethylphthalate	340.	U
7005-72-3-----	4-Chlorophenyl-phenylether	340.	U
86-73-7-----	Fluorene	340.	U
100-01-6-----	4-Nitroaniline	1700.	U
534-52-1-----	4,6-Dinitro-2-methylphenol	1700.	U
86-30-6-----	N-Nitrosodiphenylamine (1)	340.	U
101-55-3-----	4-Bromophenyl-phenylether	340.	U
118-74-1-----	Hexachlorobenzene	340.	U
87-86-5-----	Pentachlorophenol	1700.	U
85-01-8-----	Phenanthrene	340.	U
120-12-7-----	Anthracene	340.	U
84-74-2-----	Di-n-butylphthalate	470.	B
206-44-0-----	Fluoranthene	340.	U
129-00-0-----	Pyrene	340.	U
85-68-7-----	Butylbenzylphthalate	340.	U
91-94-1-----	3,3'-Dichlorobenzidine	680.	U
56-55-3-----	Benzo(a)anthracene	340.	U
218-01-9-----	Chrysene	340.	U
117-81-7-----	bis(2-Ethylhexyl)phthalate	110.	J
117-84-0-----	Di-n-octylphthalate	38.	J
205-99-2-----	Benzo(b)fluoranthene	340.	U
207-08-9-----	Benzo(k)fluoranthene	340.	U
50-32-8-----	Benzo(a)pyrene	340.	U
193-39-5-----	Indeno(1,2,3-cd)pyrene	340.	U
53-70-3-----	Dibenz(a,h)anthracene	340.	U
191-24-2-----	Benzo(g,h,i)perylene	340.	U

(1) - Cannot be separated from Diphenylamine

1F  
SEMIVOLATILE ORGANICS ANALYSIS DATA SHEET  
TENTATIVELY IDENTIFIED COMPOUNDS

EPA SAMPLE NO.

B06809

Lab Name: BATTELLE-PNL

Contract: -----

Lab Code: ----- Case No.: ----- SAS No.: ----- SDG No.: 18

Matrix: (soil/water) SOIL

Lab Sample ID: 92-06904-E1

Sample wt/vol: 30.265 (g/mL) G

Lab File ID: &gt;F0409

Level: (low/med) LOW

Date Received: 05/04/92

% Moisture: not dec.2.23 dec. --

Date Extracted: 05/12/92

Extraction: (Sepf/Cont/Sonc) SONC

Date Analyzed: 6/04/92

GPC Cleanup: (Y/N) N pH: 8.5

Dilution Factor: 1.00000

Number TICs found: 30

CONCENTRATION UNITS:  
(ug/L or ug/Kg) ug/Kg

CAS NUMBER	COMPOUND NAME	RT	EST. CONC.	Q
1.	Unknown	4.67	1100.	JAB
2.	Unknown	4.99	2800.	JAB
3.	112403 Dodecane	8.98	2200.	J
4.	Unknown alkane	9.29	2000.	J
5.	Unknown cycloalkane	9.60	850.	J
6.	Unknown alkene	10.14	1100.	J
7.	Unknown alkane	10.41	1600.	J
8.	Unknown alkane	10.66	5600.	J
9.	Unknown cycloalkane	10.89	1000.	J
10.	Unknown cycloalkane	11.06	630.	J
11.	629505 Tridecane	11.33	7700.	J
12.	Unknown alkane	11.56	780.	J
13.	Unknown alkane	11.73	1500.	J
14.	Unknown alkane	12.09	590.	J
15.	Unknown alkene	12.43	1700.	J
16.	Unknown alkane	12.72	850.	J
17.	Unknown alkane	12.86	1400.	J
18.	Unknown alkane	13.26	8100.	J
19.	Unknown cycloalkane	13.56	1500.	J
20.	629594 Tetradecane	13.87	9600.	J
21.	Unknown alkane	13.93	1200.	J
22.	Unknown alkene	15.05	1600.	J
23.	Unknown alkane	15.27	730.	J
24.	Unknown alkane	15.44	6900.	J
25.	Unknown alkane	15.60	970.	J
26.	629629 Pentadecane	16.41	7000.	J
27.	Unknown alkane	17.74	470.	J
28.	544763 Hexadecane	18.91	1700.	J
29.	126738 Phosphoric acid tributyl est	20.40	32000.	J
30.	Unknown alkane	40.71	320.	J

PCB/PESTICIDE ANALYSIS RESULTSSAMPLE ANALYSIS REPORTED

Analysis of five, 200-BP-1 samples consisting of sample delivery group eighteen (SDG #18) for pesticides and PCBs (Aroclors) by gas chromatography/electron capture detection (GC/ECD) is the subject of this report.

SAMPLE DESCRIPTION AND PREPARATION

<u>Sample ID</u>	<u>ACL Lab Number</u>
B067Y5	92-06428
B067Y7	92-06713
B067Z3	92-06726
B067Z5	92-06727-P1
B067Z5 MS	92-06727-P2
B067Z5 MSD	92-06727-P3
PBLK22 (Method Blank)	92-06727-P4
B06809	92-06904

The samples were received in good condition on 04/21/92 (B067Y5), 04/27/92 (B067Y7), 04/29/92 (B067Z3 and B067Z5) and 05/04/92 (B06809). Samples were extracted on 04/30/92, 05/12/92 and again on 05/21/92 (re-extraction).

- |                                      |                             |
|--------------------------------------|-----------------------------|
| • Extraction procedure               | PNL-ALO-347.                |
| • Extraction location                | Lab 302, 325 building       |
| • Extraction type                    | Sonication, low level, soil |
| • Sample/Extract storage temperature | 4°C(+/-2°)                  |

ANALYSIS METHOD

- |                           |                        |
|---------------------------|------------------------|
| • GC/ECD procedure:       | PNL-ALO-346.           |
| • GC/ECD instrumentation: | HP-5890 (WB60701)      |
| • GC/ECD location:        | Lab 325, 325 building. |



QUALITY CONTROL

In addition to the result forms (1D) the QC features in the analytical procedure were followed as described. The following lists the attached CLP forms that relate to QC and summarizes the QC results.

<u>Form</u>	<u>Information</u>	<u>Comments</u>
2F	Surrogate Recovery	Meets all requirements.(1)
3F	MS/MSD Recovery	Meets all requirements.
4C	Method Blank Summary	Meets all method blank requirements.
8D	Evaluation Standards	Meets all requirements.
8E	Retention Time Summary	Meets all requirements.
9	Standards Summary	%D exceeded limits for 5 compounds.(2)
1D	Extraction Holding Time	Requirements were met.(1)
1D	Analysis Holding Time	Requirements were met.

(1) Surrogate and matrix spike recoveries are advisory. Although corrective action is not required, samples B067Z3 and B067Z5 did not recover any surrogate and were re-extracted and reanalyzed. Both sets of data are reported, however only forms for the primary analysis are provided with the re-extraction data, as the re-extraction was performed beyond the maximum extraction holding time. Other than the absence of surrogate, the chromatograms of B067Z3 and B067Z5 analyzed on 05/14/92 appear identical with those from 06/11/92.

(2) %D was exceeded in the last individual mixture A & B (INDAB) analyzed for DDE, DDD, DDT, Endosulfan II and Methoxychlor. The most probable cause for the drift in responses was the widely

varying temperatures in the instrument lab that occurred during this time period.

## RESULTS

As indicated on the attached 1D Forms the blank and the samples were not found to contain target compounds at levels greater than the contract required quantitation limit (CRQL) and are "Q" flagged accordingly.

Surrogate Spike recovery results for samples B067Z3 and B067Z5 are out of criteria and were most likely inadvertently not added during extraction. Re-extraction and reanalysis of these samples was performed and surrogate recovery was found to be acceptable. Matrix Spike recovery criteria are advisory and do not require further action. This SDG was run in two separate analytical sequences.

The following defines the Q-flags in the Form 1's

<u>"Q" Flag</u>	<u>Definition</u>
U	Indicates the compound was analyzed for but not detected, the U-flagged concentration is the Contract Required Quantitation Limit.
B	Indicates compound was found in the blank.
D	Indicates analysis was performed on a diluted sample.
M	Indicates a matrix spike compound.

1D  
PESTICIDE ORGANICS ANALYSIS DATA SHEET

EPA SAMPLE NO.

B067Y5

Lab Name: Battelle PNL

Contract:

Lab Code: PNL

Case No.:

SAS No.:

SDG No.: 18

Matrix: (soil/water) SOIL

Lab Sample ID: 92-06428-P-1

Sample wt/vol: 30.16 (g/mL)G

Lab File ID: &gt;02533

Level: (low/med) LOW

Date Received: 04/21/92

% Moisture: not dec. 3.08 dec.

Date Extracted: 04/30/92

Extraction: (SepF/Cont/Sonc) SONC

Date Analyzed: 05/13/92

GPC Cleanup: (Y/N) N

pH: 8

Dilution Factor: 1

CAS NO.	COMPOUND	CONCENTRATION UNITS: (ug/L or ug/Kg) ug/Kg	Q
---------	----------	---	---

319-84-6-----	Alpha-BHC	8.20	U
319-85-7-----	Beta-BHC	8.20	U
319-86-8-----	Delta-BHC	8.20	U
58-89-9-----	Gamma-BHC (Lindane)	8.20	U
76-44-8-----	Heptachlor	8.20	U
309-00-2-----	Aldrin	8.20	U
1024-57-3-----	Heptachlor Epoxide	8.20	U
959-98-8-----	Endosulfan I	8.20	U
60-57-1-----	Dieldrin	16.00	U
72-55-9-----	4,4'-DDE	16.00	U
72-20-8-----	Endrin	16.00	U
33213-65-9-----	Endosulfan II	16.00	U
72-54-8-----	4,4'-DDD	16.00	U
1013-07-8-----	Endosulfan Sulfate	16.00	U
50-29-3-----	4,4'-DDT	16.00	U
72-43-5-----	Methoxychlor	82.00	U
53494-70-5-----	Endrin Ketone	16.00	U
5103-71-9-----	alpha-Chlordane	82.00	U
5103-74-2-----	gamma-Chlordane	82.00	U
8001-35-2-----	Toxaphene	160.00	U
12674-11-2-----	Aroclor-1016	82.00	U
11104-28-2-----	Aroclor-1221	82.00	U
11141-16-5-----	Aroclor-1232	82.00	U
53469-21-9-----	Aroclor-1242	82.00	U
12672-29-6-----	Aroclor-1248	82.00	U
11097-69-1-----	Aroclor-1254	160.00	U
11096-82-5-----	Aroclor-1260	160.00	U



1D  
PESTICIDE ORGANICS ANALYSIS DATA SHEET

EPA SAMPLE NO.

B067Y7

Lab Name: Battelle PNL

Contract:

Lab Code: PNL

Case No.:

SAS No.:

SDG No.: 18

Matrix: (soil/water) SOIL

Lab Sample ID: 92-06713-P-1

Sample wt/vol: 30.73 (g/mL)G

Lab File ID: &gt;02534

Level: (low/med) LOW

Date Received: 04/27/92

% Moisture: not dec. 2.57 dec.

Date Extracted: 04/30/92

Extraction: (SepF/Cont/Sonc) SONC

Date Analyzed: 05/13/92

GPC Cleanup: (Y/N) N pH: 9

Dilution Factor: 1

CAS NO.	COMPOUND	CONCENTRATION UNITS: (ug/L or ug/Kg) ug/Kg	Q
---------	----------	---	---

319-84-6-----	Alpha-BHC	8.00	U
319-85-7-----	Beta-BHC	8.00	U
319-86-8-----	Delta-BHC	8.00	U
58-89-9-----	Gamma-BHC (Lindane)	8.00	U
76-44-8-----	Heptachlor	8.00	U
309-00-2-----	Aldrin	8.00	U
1024-57-3-----	Heptachlor Epoxide	8.00	U
959-98-8-----	Endosulfan I	8.00	U
60-57-1-----	Dieldrin	16.00	U
72-55-9-----	4,4'-DDE	16.00	U
72-20-8-----	Endrin	16.00	U
33213-65-9-----	Endosulfan II	16.00	U
72-54-8-----	4,4'-DDD	16.00	U
1013-07-8-----	Endosulfan Sulfate	16.00	U
50-29-3-----	4,4'-DDT	16.00	U
72-43-5-----	Methoxychlor	80.00	U
53494-70-5-----	Endrin Ketone	16.00	U
5103-71-9-----	alpha-Chlordane	80.00	U
5103-74-2-----	gamma-Chlordane	80.00	U
8001-35-2-----	Toxaphene	160.00	U
12674-11-2-----	Aroclor-1016	80.00	U
11104-28-2-----	Aroclor-1221	80.00	U
11141-16-5-----	Aroclor-1232	80.00	U
53469-21-9-----	Aroclor-1242	80.00	U
12672-29-6-----	Aroclor-1248	80.00	U
11097-69-1-----	Aroclor-1254	160.00	U
11096-82-5-----	Aroclor-1260	160.00	U

1D  
PESTICIDE ORGANICS ANALYSIS DATA SHEET

EPA SAMPLE NO.

Lab Name: Battelle PNL

Contract:

B06723

Lab Code: PNL

Case No.:

SAS No.:

SDG No.: 18

Matrix: (soil/water) SOIL

Lab Sample ID: 92-06726-P-1

Sample wt/vol: 30.49 (g/mL)G

Lab File ID: &gt;02535

Level: (low/med) LOW

Date Received: 04/29/92

% Moisture: not dec. 3.35 dec.

Date Extracted: 04/30/92

Extraction: (SepF/Cont/Sonc) SONC

Date Analyzed: 05/13/92

GPC Cleanup: (Y/N) N pH: 9

Dilution Factor: 1

CONCENTRATION UNITS:  
(ug/L or ug/Kg) ug/Kg

CAS NO.	COMPOUND	Q
319-84-6-----	Alpha-BHC	8.10 U
319-85-7-----	Beta-BHC	8.10 U
319-86-8-----	Delta-BHC	8.10 U
58-89-9-----	Gamma-BHC (Lindane)	8.10 U
76-44-8-----	Heptachlor	8.10 U
309-00-2-----	Aldrin	8.10 U
1024-57-3-----	Heptachlor Epoxide	8.10 U
959-98-8-----	Endosulfan I	8.10 U
60-57-1-----	Dieldrin	16.00 U
72-55-9-----	4,4'-DDE	16.00 U
72-20-8-----	Endrin	16.00 U
33213-65-9-----	Endosulfan II	16.00 U
72-54-8-----	4,4'-DDD	16.00 U
1013-07-8-----	Endosulfan Sulfate	16.00 U
50-29-3-----	4,4'-DDT	16.00 U
72-43-5-----	Methoxychlor	81.00 U
53494-70-5-----	Endrin Ketone	16.00 U
5103-71-9-----	alpha-Chlordane	81.00 U
5103-74-2-----	gamma-Chlordane	81.00 U
8001-35-2-----	Toxaphene	160.00 U
12674-11-2-----	Aroclor-1016	81.00 U
11104-28-2-----	Aroclor-1221	81.00 U
11141-16-5-----	Aroclor-1232	81.00 U
53469-21-9-----	Aroclor-1242	81.00 U
12672-29-6-----	Aroclor-1248	81.00 U
11097-69-1-----	Aroclor-1254	160.00 U
11096-82-5-----	Aroclor-1260	160.00 U



1D  
PESTICIDE ORGANICS ANALYSIS DATA SHEET

EPA SAMPLE NO.

Lab Name: Battelle PNL

Contract:

B067Z3

Lab Code: PNL

Case No.:

SAS No.:

SDG No.: 18

Matrix: (soil/water) SOIL

Lab Sample ID: 92-06726-P1

Sample wt/vol: 30.45 (g/mL)G

Lab File ID: &gt;02605

Level: (low/med) LOW

Date Received: 04/29/92

% Moisture: not dec. 3.35 dec.

Date Extracted: 05/21/92

Extraction: (SepF/Cont/Sonc) SONC

Date Analyzed: 06/11/92

GPC Cleanup: (Y/N) N pH: 9

Dilution Factor: 1

CONCENTRATION UNITS:  
(ug/L or ug/Kg) ug/Kg

CAS NO.	COMPOUND	Q
319-84-6-----	Alpha-BHC	8.20 U
319-85-7-----	Beta-BHC	8.20 U
319-86-8-----	Delta-BHC	8.20 U
58-89-9-----	Gamma-BHC (Lindane)	8.20 U
76-44-8-----	Heptachlor	8.20 U
309-00-2-----	Aldrin	8.20 U
1024-57-3-----	Heptachlor Epoxide	8.20 U
959-98-8-----	Endosulfan I	8.20 U
60-57-1-----	Dieldrin	16.00 U
72-55-9-----	4,4'-DDE	16.00 U
72-20-8-----	Endrin	16.00 U
33213-65-9-----	Endosulfan II	16.00 U
72-54-8-----	4,4'-DDD	16.00 U
1013-07-8-----	Endosulfan Sulfate	16.00 U
50-29-3-----	4,4'-DDT	16.00 U
72-43-5-----	Methoxychlor	82.00 U
53494-70-5-----	Endrin Ketone	16.00 U
5103-71-9-----	alpha-Chlordane	82.00 U
5103-74-2-----	gamma-Chlordane	82.00 U
8001-35-2-----	Toxaphene	160.00 U
12674-11-2-----	Aroclor-1016	82.00 U
11104-28-2-----	Aroclor-1221	82.00 U
11141-16-5-----	Aroclor-1232	82.00 U
53469-21-9-----	Aroclor-1242	82.00 U
12672-29-6-----	Aroclor-1248	82.00 U
11097-69-1-----	Aroclor-1254	160.00 U
11096-82-5-----	Aroclor-1260	160.00 U



1D  
PESTICIDE ORGANICS ANALYSIS DATA SHEET

EPA SAMPLE NO.

B067Z5

Lab Name: Battelle PNL

Contract:

Lab Code: PNL

Case No.:

SAS No.:

SDG No.: 18

Matrix: (soil/water) SOIL

Lab Sample ID: 92-06727-P-1

Sample wt/vol: 30.76 (g/mL)G

Lab File ID: &gt;02536

Level: (low/med) LOW

Date Received: 04/29/92

% Moisture: not dec. 2.2 dec.

Date Extracted: 04/30/92

Extraction: (SepF/Cont/Sonc) SONC

Date Analyzed: 05/13/92

GPC Cleanup: (Y/N) N

pH: 10.2

Dilution Factor: 1

CAS NO.	COMPOUND	CONCENTRATION UNITS:	
		(ug/L or ug/Kg)	ug/Kg
			Q
319-84-6-----	Alpha-BHC	8.00	U
319-85-7-----	Beta-BHC	8.00	U
319-86-8-----	Delta-BHC	8.00	U
58-89-9-----	Gamma-BHC (Lindane)	8.00	U
76-44-8-----	Heptachlor	8.00	U
309-00-2-----	Aldrin	8.00	U
1024-57-3-----	Heptachlor Epoxide	8.00	U
959-98-8-----	Endosulfan I	8.00	U
60-57-1-----	Dieldrin	16.00	U
72-55-9-----	4,4'-DDE	16.00	U
72-20-8-----	Endrin	16.00	U
33213-65-9-----	Endosulfan II	16.00	U
72-54-8-----	4,4'-DDD	16.00	U
1013-07-8-----	Endosulfan Sulfate	16.00	U
50-29-3-----	4,4'-DDT	16.00	U
72-43-5-----	Methoxychlor	80.00	U
53494-70-5-----	Endrin Ketone	16.00	U
5103-71-9-----	alpha-Chlordane	80.00	U
5103-74-2-----	gamma-Chlordane	80.00	U
8001-35-2-----	Toxaphene	160.00	U
12674-11-2-----	Aroclor-1016	80.00	U
11104-28-2-----	Aroclor-1221	80.00	U
11141-16-5-----	Aroclor-1232	80.00	U
53469-21-9-----	Aroclor-1242	80.00	U
12672-29-6-----	Aroclor-1248	80.00	U
11097-69-1-----	Aroclor-1254	160.00	U
11096-82-5-----	Aroclor-1260	160.00	U

1D  
PESTICIDE ORGANICS ANALYSIS DATA SHEET

EPA SAMPLE NO.

B06725

Lab Name: Battelle PNL

Contract:

Lab Code: PNL

Case No.:

SAS No.:

SDG No.: 18

Matrix: (soil/water) SOIL

Lab Sample ID: 92-06727-P1

Sample wt/vol: 30.73 (g/mL)G

Lab File ID: &gt;02606

Level: (low/med) LOW

Date Received: 04/29/92

% Moisture: not dec. 2.2 dec.

Date Extracted: 05/21/92

Extraction: (SepF/Cont/Sonc) SONC

Date Analyzed: 06/11/92

GPC Cleanup: (Y/N) N

pH: 10.2

Dilution Factor: 1

CAS NO.	COMPOUND	CONCENTRATION UNITS: (ug/L or ug/Kg) ug/Kg	Q
---------	----------	---	---

319-84-6-----	Alpha-BHC	8.00	U
319-85-7-----	Beta-BHC	8.00	U
319-86-8-----	Delta-BHC	8.00	U
58-89-9-----	Gamma-BHC (Lindane)	8.00	U
76-44-8-----	Heptachlor	8.00	U
309-00-2-----	Aldrin	8.00	U
1024-57-3-----	Heptachlor Epoxide	8.00	U
959-98-8-----	Endosulfan I	8.00	U
60-57-1-----	Dieldrin	16.00	U
72-55-9-----	4,4'-DDE	16.00	U
72-20-8-----	Endrin	16.00	U
33213-65-9-----	Endosulfan II	16.00	U
72-54-8-----	4,4'-DDD	16.00	U
1013-07-8-----	Endosulfan Sulfate	16.00	U
50-29-3-----	4,4'-DDT	16.00	U
72-43-5-----	Methoxychlor	80.00	U
53494-70-5-----	Endrin Ketone	16.00	U
5103-71-9-----	alpha-Chlordane	80.00	U
5103-74-2-----	gamma-Chlordane	80.00	U
8001-35-2-----	Toxaphene	160.00	U
12674-11-2-----	Aroclor-1016	80.00	U
11104-28-2-----	Aroclor-1221	80.00	U
11141-16-5-----	Aroclor-1232	80.00	U
53469-21-9-----	Aroclor-1242	80.00	U
12672-29-6-----	Aroclor-1248	80.00	U
11097-69-1-----	Aroclor-1254	160.00	U
11096-82-5-----	Aroclor-1260	160.00	U

FORM I PEST

1/89 Rev.



1D  
PESTICIDE ORGANICS ANALYSIS DATA SHEET

EPA SAMPLE NO.

B06809

Lab Name: Battelle PNL

Contract:

Lab Code: PNL

Case No.:

SAS No.:

SDG No.: 18

Matrix: (soil/water) SOIL

Lab Sample ID: 92-06904-P1

Sample wt/vol: 30.26 (g/mL)G

Lab File ID: &gt;02581

Level: (low/med) LOW

Date Received: 05/04/92

% Moisture: not dec. 2.23 dec.

Date Extracted: 05/12/92

Extraction: (SepF/Cont/Sonc) SONC

Date Analyzed: 06/10/92

GPC Cleanup: (Y/N) N

pH: 8.5

Dilution Factor: 1

CAS NO.	COMPOUND	CONCENTRATION UNITS: (ug/L or ug/Kg) ug/Kg	Q
---------	----------	---	---

319-84-6	Alpha-BHC	8.10	U
319-85-7	Beta-BHC	8.10	U
319-86-8	Delta-BHC	8.10	U
58-89-9	Gamma-BHC (Lindane)	8.10	U
76-44-8	Heptachlor	8.10	U
309-00-2	Aldrin	8.10	U
1024-57-3	Heptachlor Epoxide	8.10	U
959-98-8	Endosulfan I	8.10	U
60-57-1	Dieldrin	16.00	U
72-55-9	4,4'-DDE	16.00	U
72-20-8	Endrin	16.00	U
33213-65-9	Endosulfan II	16.00	U
72-54-8	4,4'-DDD	16.00	U
1013-07-8	Endosulfan Sulfate	16.00	U
50-29-3	4,4'-DDT	16.00	U
72-43-5	Methoxychlor	81.00	U
53494-70-5	Endrin Ketone	16.00	U
5103-71-9	alpha-Chlordane	81.00	U
5103-74-2	gamma-Chlordane	81.00	U
8001-35-2	Toxaphene	160.00	U
12674-11-2	Aroclor-1016	81.00	U
11104-28-2	Aroclor-1221	81.00	U
11141-16-5	Aroclor-1232	81.00	U
53469-21-9	Aroclor-1242	81.00	U
12672-29-6	Aroclor-1248	81.00	U
11097-69-1	Aroclor-1254	160.00	U
11096-82-5	Aroclor-1260	160.00	U



SAMPLE RECEIPT FORMDelivered by: W. S. Thompson Date/Time: 4/21/02Received by: [Signature]Customer Name or Project: 16722Customer Sample Number(s): B06745ALO Sample Number(s): 92-06428

1. Customer Chain-of-Custody Form: Present X Absent
2. Additional Shipping Forms (list): SAR ORSR
3. Custody Seals on Shipping and/or Sample Containers and their Conditions.  
Present X Absent         
If Present, Condition: intact
4. Sample Tag(s) ID Numbers if not Recorded on the Chain-of-Custody Record or on Sample Vial.  
good  
Notes:
5. Condition of Shipping Container (i.e., broken container, dented, breached plastic bag, temperature of sample container as defined in Section 3.0 in PNL-ALO-051, etc.) good -6°C
6. Condition of Sample Vials. good
7. Verification of Agreement or Nonagreement of Information on Receiving Documents. N/A
8. Resolution of Problems or Discrepancies. N/A

RETURN COMPLETED FORM TO PROJECT MANAGER

B01-002

Westinghouse Hanford  
Company

## CHAIN OF CUSTODY

Custody Form Initiator W.S. Thompson Project #: 91-019  
 Company Contact W. S. Thompson Telephone (509) 376-2153  
 Project Designation/Sampling Locations 200-BP-1 Operable Unit Collection Date 4-16-92  
 Boring: 216-B-47A Time: 1100  
 Ice Chest No. 391DA & SML159 Field Logbook No. WHC-11-385-12  
 Bill of Lading/Airbill No. 11/A Offsite Property No. 11/A  
 Method of Shipment Hand Carry

Shipped to 325 PNL Laboratory (300 Area) Allen Rick Steele 376-3089 <sup>Dimrad</sup>  
 Possible Sample Hazards/Remarks SAMPLES ARE RADIOACTIVE: 120ml = 100mR/hr, 150ml = 100mrad/hr, 1000ml = 200mR/hr, 125ml = 100mR/hr, 150ml = 100mrad/hr, 125ml = 100mR/hr  
No chemical hazards detected. Keep Samples Chilled. All analyses CLP. See lab statement of work

## Sample Identification

① B06745

1,120ml, amber glass, soil; CLP-VDA  
 1,950ml, amber glass, soil; CLP-Semi-VDA, Pest/PCB, TOC  
 1,000ml, glass, soil; CLP-total alpha/beta, GEA, Sr90, Cs137, Pu238, Pu239/240, Rn106,  
 1,125ml, glass, soil; CLP-total alpha, free ion, ferrous, metals, CP/MS, Bi, Tgs, NG, SC,  
 ICP/AA, total uranium

Field Transfer of Custody

## CHAIN OF POSSESSION

(Sign and Print Names)

Relinquished by: <u>W.S. Thompson</u>	Received by: <u>Rick Steele</u>	Date/Time: <u>4/21/92 1120hrs</u>
Relinquished by:	Received by:	Date/Time:
Relinquished by:	Received by:	Date/Time:
Relinquished by:	Received by:	Date/Time:

## Final Sample Disposition

Disposal Method:	Disposed by:	Date/Time:
Comments:		







SAMPLE RECEIPT FORMDelivered by: Wendy Thompson Date/Time: 4-27-92 12:40Received by: DIANA McMullinCustomer Name or Project: 200-BP-1Customer Sample Number(s): B067Y7ALO Sample Number(s): 92-06713

1. Customer Chain-of-Custody Form: Present ☒ Absent ☐
2. Additional Shipping Forms (list): ARF, activity form, RSR
3. Custody Seals on Shipping and/or Sample Containers and their Conditions.  
Present ☒ Absent ☐  
If Present, Condition: good
4. Sample Tag(s) ID Numbers if not Recorded on the Chain-of-Custody Record or on Sample Vial. 0528  
Notes:
5. Condition of Shipping Container (i.e., broken container, dented, breached plastic bag, temperature of sample container as defined in Section 3.0 in PNL-ALO-051, etc.) good
6. Condition of Sample Vials. good
7. Verification of Agreement or Nonagreement of Information on Receiving Documents. N/A
8. Resolution of Problems or Discrepancies. N/A

Diana McMullin  
4-27-92

RETURN COMPLETED FORM TO PROJECT MANAGER

B01-005





[illegible]

\*Indicate whether sample is soil, sludge, water, etc

\*\*Use back of page for additional information relative to sample location

A 6000 406 (05/90)

**B01-007**



SAMPLE RECEIPT FORMDelivered by: Wendy Thompson Date/Time: 4-27-92 1:30 pmReceived by: Sim Robbins / Diana BellofattoCustomer Name or Project: 200-BP-1Customer Sample Number(s): B06747, B06720, B06722ALO Sample Number(s): 92-06713, 92-06724, 92-06725

1. Customer Chain-of-Custody Form: Present X Absent \_\_\_\_\_
2. Additional Shipping Forms (list): SAR, ORSR
3. Custody Seals on Shipping and/or Sample Containers and their Conditions.  
Present X Absent \_\_\_\_\_  
If Present, Condition: intact
4. Sample Tag(s) ID Numbers if not Recorded on the Chain-of-Custody Record or on Sample Vial.

Notes:

5. Condition of Shipping Container (i.e., broken container, dented, breached plastic bag, temperature of sample container as defined in Section 3.0 in PNL-ALO-051, etc.)  
good 2°C
6. Condition of Sample Vials. good
7. Verification of Agreement or Nonagreement of Information on Receiving Documents.  
N/A
8. Resolution of Problems or Discrepancies.  
N/A

RETURN COMPLETED FORM TO PROJECT MANAGER

B01-008

Westinghouse Hanford  
Company

## CHAIN OF CUSTODY

Custody Form Initiator M.C. Douglas Project #: 91-019  
 Company Contact W. S. Thompson Telephone (509) 376-2153  
 Project Designation/Sampling Locations 200-AP-1 Operable Unit Collection Date 4-27-92  
 Boring: 216-B-47A Time: 0945  
 Ice Chest No. EF5618 Field Logbook No. WHC-II-305-12  
 Bill of Lading/Airbill No. II/A Offsite Property No. II/A  
 Method of Shipment Hand Carry

Shipped to 325 PNL Laboratory (300 Area) D. Bellofatto

Possible Sample Hazards/Remarks Sample is radioactive, 950ml jar = 12mrad/hr,  
950ml jar = 15,000 cpm - All analysis is CLP. See Lab statement of work.  
4-27-92

Sample Identification

① B067Y7, 4-27-92

1, 720ml, amber glass, soil; CLP - Semi-VOA, Pest, PCB's, TOC  
1, 950ml, amber glass, soil; CLP; \*CLP-VOA  
120Wx 4-27-92 WST 4-27-92

## Field Transfer of Custody

## CHAIN OF POSSESSION

(Sign and Print Names)

Relinquished by: <u>M.C. Douglas</u> <u>Matthew C. Douglas</u>	Received by: <u>W.S. Thompson</u> <u>Kendys Thompson</u>	Date/Time: <u>4-27-92 0830</u>
Relinquished by: <u>W.S. Thompson</u> <u>Kendys Thompson</u>	Received by: <u>Diana Bellofatto</u> <u>Diana Bellofatto</u>	Date/Time: <u>4-27-92 1:30 pm</u>
Relinquished by:	Received by:	Date/Time:
Relinquished by:	Received by:	Date/Time:

## Final Sample Disposition

Disposal Method:	Disposed by:	Date/Time:
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Comments:

B01-009



**B01-010**



Westinghouse Hanford  
Company

## CHAIN OF CUSTODY

Custody Form Initiator M.C. Douglas

Project #: 91-019

Company Contact W. S. Thompson

Telephone (509) 376-2153

Project Designation/Sampling Locations 200-BP-1 Operable UnitCollection Date 4-22-92Boring: 21k-B-47ATime: 0945Ice Chest No. FF6618Field Logbook No. WHC-II-385-12Bill of Lading/Airbill No. II/AOffsite Property No. II/AMethod of Shipment Hand CarryShipped to 325 PNL Laboratory (300 Area)Possible Sample Hazards/Remarks Sample is radioactive. 1mR/hr, 3mrad/hr. All analysis is CLP. See lab statement & work. Keep sample chilled

Sample Identification

① B067Y7

1,125 ml glass; soil; CLP - total Cn, free Cn, ferrocen, total uranium, P, Cu, Bi, CP/AA metals, ICP/MS, NO<sub>3</sub>, SO<sub>4</sub>, PO<sub>4</sub>☒ Field Transfer of Custody

## CHAIN OF POSSESSION

(Sign and Print Names)

Relinquished by: M.C. DouglasReceived by: W.S. Thompson

Date/Time:

Matthew C. DouglasGendy Thompson4-27-92 0830Relinquished by: W.S. ThompsonReceived by: J. ROBBINS

Date/Time:

Gendy ThompsonJames Robbins4-27-92 1330

Relinquished by:

Received by:

Date/Time:

Relinquished by:

Received by:

Date/Time:

## Final Sample Disposition

Disposal Method:

Disposed by:

Date/Time:

Comments:

B01-011

**B01-012**



Westinghouse Hanford  
Company

## CHAIN OF CUSTODY

Custody Form Initiator M. C. DouglasProject #: 91-019Company Contact W. S. ThompsonTelephone (509) 376-2153Project Designation/Sampling Locations 200-RP-1 Operable UnitCollection Date 4-23-92Boring: 216-B-43BTime: 1027, 1324Ice Chest No. SML101Field Logbook No. WHC-II-385-12Bill of Lading/Airbill No. II/AOffsite Property No. II/AMethod of Shipment Hand CarryShipped to 325 PNL Laboratory (300 Area)Possible Sample Hazards/Remarks Samples are nonhazardous. Keep Samples chilled.All analyses CLP. See lab statement of work.

## Sample Identification

① B067201, 125 ml, glass, soil, CLP- Total Cn, Free Cn, Ferro Cn.② B067221, 125 ml, glass, soil, CLP- Total Cn, Free Cn, Ferro Cn.

## Field Transfer of Custody

## CHAIN OF POSSESSION

(Sign and Print Names)

Relinquished by: M. C. DouglasReceived by: W. S. ThompsonDate/Time: 0830Matthew C. DouglasKendy S. Thompson4-27-92Relinquished by: W. S. ThompsonReceived by: J. ROBBINS

Date/Time:

Kendy S. ThompsonJ. Robbins4-27-92 1330

Relinquished by:

Received by:

Date/Time:

Relinquished by:

Received by:

Date/Time:

## Final Sample Disposition

Disposal Method:

Disposed by:

Date/Time:

Comments:



**B01-014**

SAMPLE RECEIPT FORMDelivered by: Wendy Thompson Date/Time: 4/29/92 2:30Received by: S. K. FodoffCustomer Name or Project: 200 BP1Customer Sample Number(s): B06723 B06725ALO Sample Number(s): 92-06726 92-06727

1. Customer Chain-of-Custody Form: Present ☒ Absent ☐
2. Additional Shipping Forms (list): Cog C, analysis request, activity record, RSR, rad shipment checklist, container inspection checklist
3. Custody Seals on Shipping and/or Sample Containers and their Conditions.  
Present ☒ Absent ☐  
If Present, Condition: in tact
4. Sample Tag(s) ID Numbers if not Recorded on the Chain-of-Custody Record or on Sample Vial.  
Notes: 0982 - tag closing shipping container -- metal
5. Condition of Shipping Container (i.e., broken container, dented, breached plastic bag, temperature of sample container as defined in Section 3.0 in PNL-ALO-051, etc.)  
in tact
6. Condition of Sample Vials.  
in tact
7. Verification of Agreement or Nonagreement of Information on Receiving Documents.  
Agree
8. Resolution of Problems or Discrepancies.  
NA

J. L. Fodoff  
4/29/92

RETURN COMPLETED FORM TO PROJECT MANAGER

B01-015



Westinghouse Hanford Company	CHAIN OF CUSTODY	
Custody Form Initiator <u>W.S. Thompson</u>	Project #: <u>91-019</u>	
Company Contact <u>H. S. Thompson</u>	Telephone <u>(509) 376-2153</u>	
Project Designation/Sampling Locations <u>200-RP-1 Operable Unit</u>	Collection Date <u>4-24-92</u>	
Boring: <u>216-B-43B</u>	Time <u>#1133; #2930</u>	
Ice Chest No. <u>WST 544140 DA39</u>	Field Logbook No. <u>WHC-385-12</u>	
Bill of Lading/Airbill No. <u>4-24-92</u> <u>N/A</u>	Offsite Property No. <u>N/A</u>	
Method of Shipment <u>Hand Carry</u>		
Shipped to <u>329 PHL Laboratory</u> <u>Attn: Nancy Wynhoff</u>		
Possible Sample Hazards/Remarks <u>Samples are radioactive. Keep samples chilled. All analysis is CLP. See lab statement of work.</u>		
<div style="display: flex; justify-content: space-between;"> <div> <p>① <u>B067Z3 (600cpm)</u></p> <p><u>B06Z WST 4-24-92</u></p> <p><u>1,1000ml, glass, soil; CLP-total <math>\alpha</math>, total Beta, GEA, Sr90, Cs137, Co60, Pu238, Pu239/240</u></p> <p><u>Ru106</u></p> </div> <div> <p>② <u>B067Z5 (15mR/h, 15mrad/h)</u></p> <p><u>1,1000ml, glass, soil; CLP-total <math>\alpha</math>, total Beta, GEA, Sr90, Cs137, Co60, Pu238, Pu239/240</u></p> <p><u>Ru106</u></p> </div> </div>		
<div style="display: flex; justify-content: space-between;"> <div> <p><input type="checkbox"/> Field Transfer of Custody</p> </div> <div> <p style="text-align: center;">CHAIN OF POSSESSION</p> </div> <div> <p style="text-align: right;">(Sign and Print Names)</p> </div> </div>		
Relinquished by: <u>W.S. Thompson</u>	Received by: <u>S. K. Fadeff</u>	Date/Time: <u>4/29/92 ; 2:30</u>
Relinquished by: <u>Nancy S. Thompson</u>	Received by: <u>S.K. Fadeff</u>	Date/Time:
Relinquished by:	Received by:	Date/Time:
Relinquished by:	Received by:	Date/Time:
Final Sample Disposition		
Disposal Method:	Disposed by:	Date/Time:
Comments:		





SAMPLE RECEIPT FORMDelivered by: Wendy Thompson Date/Time: 4-29-92 3:15 pmReceived by: Diana BelloGatto / Jim RobbinsCustomer Name or Project: 200-BP-1Customer Sample Number(s): B06723 B06725ALO Sample Number(s): 92-06726 92-06727

1. Customer Chain-of-Custody Form: Present X Absent
2. Additional Shipping Forms (list): SAR OSR
3. Custody Seals on Shipping and/or Sample Containers and their Conditions.  
Present X Absent         
If Present, Condition: intact
4. Sample Tag(s) ID Numbers if not Recorded on the Chain-of-Custody Record or on Sample Vial.  
Notes: good
5. Condition of Shipping Container (i.e., broken container, dented, breached plastic bag, temperature of sample container as defined in Section 3.0 in PNL-ALO-051, etc.)  
good 1°C
6. Condition of Sample Vials. good
7. Verification of Agreement or Nonagreement of Information on Receiving Documents.  
N/A
8. Resolution of Problems or Discrepancies.  
N/A

RETURN COMPLETED FORM TO PROJECT MANAGER

B01-018



Westinghouse Hanford  
Company

## CHAIN OF CUSTODY

Custody Form Initiator W.S. Thompson Project #: 91-019  
 Company Contact: W. S. Thompson Telephone (509) 376-2153  
 Project Designation/Sampling Locations 200-RP-1 Operable Unit Collection Date 4-24-92  
 Boring: 216-B-43B Time: 0930; 1133  
 Ice Chest No. SML 140 Field Logbook No. WHC-II-385-12  
 Bill of Lading/Airbill No. 11/A Offsite Property No. 11/A  
 Method of Shipment Hand Carry

Shipped to 325 PNL Laboratory (300 Area) D. BellofattoPossible Sample Hazards/Remarks Samples are radioactive. Keep samples chilled-all analysis is CLP- See lab Statement of work

## Sample Identification

① BO67Z5 (120ml = 30mrad/hr, 4.5mR/hr; 950ml = 15mR/hr, 5mrad/hr)  
 1, 120ml, amber glass soil, CLP-VOA

② BO67Z3 1, 950 ml, amber glass, soil; CLP-Semi-VOA, Pest, PCB, TOC  
WS 4-24-92

② BO67Z3 (120ml = 500cpm, 950ml = 800cpm)

1, 120ml, amber glass, soil; CLP-VOA

1, 950ml, amber glass, soil; CLP-Semi-VOA, Pest, PCB, TOC

☐ Field Transfer of Custody

## CHAIN OF POSSESSION

(Sign and Print Names)

Relinquished by: W.S. Thompson Received by: Diana Bellofatto Date/Time: 4-29-92 3:15pm  
Shady Thompson Diana Bellofatto

Relinquished by: Received by: Date/Time:

Relinquished by: Received by: Date/Time:

Relinquished by: Received by: Date/Time:

## Final Sample Disposition

Disposal Method: Disposed by: Date/Time:

Comments:



Westinghouse Hanford Company		SAMPLE ANALYSIS REQUEST	
PART I: FIELD SECTION			
Collector <u>W.S. Thompson</u>		Date Sampled <u>4-24-92</u> Time <u>0930</u> hours	
Company Contact <u>W.S. Thompson</u>		Telephone <u>(509) 376-7153</u> <u>1133</u>	
Sample Number	Number and Type of Sample Containers	Type of Sample*	Analysis Requested
① B06725	1, 120ml, amber glass, soil; CLP- 1, 950ml, amber glass, soil; CLP-	VOA <del>Semi-VOA, Pest, PCB, TOC</del>	<u>WST 4-24-92</u>
② B06723	1, 120ml, amber glass, soil; CLP- 1, 950ml, amber glass, soil; CLP-	VOA <del>Semi-VOA, Pest, PCB, TOC</del>	
/			
Field Information** <u>Samples support 200-BP1 (Task 2/4). All analyses</u> <u>is CLP. See Lab statement of work. 216-b-43B borehole</u>			
Special Handling and/or Storage <u>Keep samples chilled</u>			
Possible Sample Hazards <u>Samples are radioactive.</u> <u>① 120ml = 30 mrad/hr, 40.5 mR/hr    ② 120ml = 500 cpm</u> <u>950ml = 15 mR/hr, 15 mrad/hr    950 = 800 cpm</u>			
PART II: LABORATORY SECTION			
Received by <u>Karina Bellegard</u>		Title <u>Senior Technician</u> Date <u>4-29-92</u>	
Analysis Required _____			

\*Indicate whether sample is soil, sludge, water, etc

\*\*Use back of page for additional information relative to sample location

A 6000 406 (05/90)

9713508.1919

Westinghouse Hanford  
Company

## CHAIN OF CUSTODY

Custody Form Initiator W.S. Thompson Project #: 91-019  
 Company Contact U. S. Thompson Telephone (509) 376-2153  
 Project Designation/Sampling Locations 200-RP-1 Operable Unit Collection Date 4-24-92  
 Boring: 216-B-438 Time: 0930, 1133  
 Ice Chest No. SML140 Field Logbook No. WHC-II-385-12  
 Bill of Lading/Airbill No. 11/A Offsite Property No. 11/A  
 Method of Shipment Hand Carry

Shipped to 325 PNL Laboratory (300 Area) Jim Robbins

Possible Sample Hazards/Remarks Samples are radioactive. All analyses w/CLP  
See Lab Attachment of work. Keep samples chilled.

## Sample Identification

(1) B06725 (4mR/hr, 18mrad/hr)

1, 125ml, glass; soil; CLP-total cn, green, ferrocn, Bi, IC/PA metals, NO<sub>3</sub>, SO<sub>4</sub>, PO<sub>4</sub>,  
Teqg, total uranium, IC/MS

(2) B06723 (c pm <sup>WST 4-24-92</sup> range)

1, 125ml, glass; soil; CLP-total cn, green, ferrocn, Bi, IC/PA metals, NO<sub>3</sub>, SO<sub>4</sub>, PO<sub>4</sub>,  
Teqg, total IC/MS  
uranium

## Field Transfer of Custody

## CHAIN OF POSSESSION

(Sign and Print Names)

Relinquished by: <u>W.S. Thompson</u>	Received by: <u>J. Robbins</u>	Date/Time: <u>4-29-92 3:30</u>
<u>Wendy Thompson</u>	<u>J. Robbins</u>	
Relinquished by:	Received by:	Date/Time:
Relinquished by:	Received by:	Date/Time:
Relinquished by:	Received by:	Date/Time:

## Final Sample Disposition

Disposal Method:	Disposed by:	Date/Time:
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Comments:

B01-021

A-6000-407 (12/90)





Telephone (509) 376-2153 1133

[illegible]

4-29-92

**B01-022**



SAMPLE RECEIPT FORMDelivered by: N. DOUGLAS Date/Time: 4-30-92 1315Received by: J. ROBBINSCustomer Name or Project: 200 BP-1 TASK 2d4Customer Sample Number(s): B06778, B06800, B06802, B06804ALO Sample Number(s): 92-06862, 92-06863, 92-06864, 92-068651. Customer Chain-of-Custody Form: Present ☒ Absent ☐

2. Additional Shipping Forms (list):

SAR

3. Custody Seals on Shipping and/or Sample Containers and their Conditions.

Present ☒ Absent ☐If Present, Condition: INTACT

4. Sample Tag(s) ID Numbers if not Recorded on the Chain-of-Custody Record or on Sample Vial.

Notes: N/A

5. Condition of Shipping Container (i.e., broken container, dented, breached plastic bag, temperature of sample container as defined in Section 3.0 in PNL-ALO-051, etc.)

OK 3°C

6. Condition of Sample Vials.

OK

7. Verification of Agreement or Nonagreement of Information on Receiving Documents.

OK

8. Resolution of Problems or Discrepancies.

OK

RETURN COMPLETED FORM TO PROJECT MANAGER

B01-023

Westinghouse Hanford  
Company

## CHAIN OF CUSTODY

Custody Form Initiator M. C. Douglas

Project #: 91-019

Company Contact W. S. Thomson

Telephone (509) 376-2153

Project Designation/Sampling Locations 200-RP-1 Operable UnitCollection Date 4-27-92 4-27-92Boring: 216-B-47B ± 216-B-43CTime: 0840 0915 0840 0914Ice Chest No. SML-101Field Logbook No. WHC-11-305-12Bill of Lading/Airbill No. 11/AOffsite Property No. 11/AMethod of Shipment Hand CarryShipped to 325 PNL Laboratory (300 Area) Attn: Jim RobbinsPossible Sample Hazards/Remarks Samples are nonhazardous. All analysis CLP.Keep samples chilled.See lab statement of work.

## Sample Identification

① B067281, 125ml, glass, soil, CLP - Total Cn, Free Cn, Ferro Cn② B068001, 125ml, glass, soil, CLP - Total Cn, Free Cn, Ferro Cn③ B068021, 125ml, glass, soil, CLP - Total Cn, Free Cn, Ferro Cn④ B068041, 125ml, glass, soil, CLP - Total Cn, Free Cn, Ferro Cn☐ Field Transfer of Custody

## CHAIN OF POSSESSION

(Sign and Print Names)

Relinquished by: M. C. DouglasReceived by: J. ROBBINS

Date/Time:

Matthew C. DouglasJ. Robbins4-30-92 1315

Relinquished by:

Received by:

Date/Time:

Relinquished by:

Received by:

Date/Time:

Relinquished by:

Received by:

Date/Time:

## Final Sample Disposition

Disposal Method:

Disposed by:

Date/Time:

Comments:



**B01-025**



9713508.1924

mco 4-30-92

B06728

SAMPLE STATUS REPORT FOR E 2105, E-FLANK  
DISPATCHED: 4/14/92 14:21  
RECEIVED: 4/27/92 11:54

TIME: 4-25-92 3:07  
SAMPLE HAS NOT BEEN SLURPED

EXT.	DETER.	RESULTS OR STATUS	OUT OF GOOD CHARGE	RANGE	CHGT	CODE
4271	TOT-ACT	8.000000E 01 P101.5	N			PS22F

END OF REPORT

B01-026

9713508.1925

04/29/92 08:25 2306 0170

1113 00

ENT FIELD 010

0000

mco 4-30-92

B06800

SAMPLE STATUS REPORT FOR E 2306, 2-BLANK

DISPATCHED: 4/14/92 14:21

TIME: 4/29/92 9: 1

RECEIVED: 4/28/92 18: 1

SAMPLE HAS NOT BEEN BLURRED

EXT. DETER. RESULTS OR STATUS  
\*\*\*\* \*\*\*\*\*  
4271 TOT-ACT < 3.00000E 01 PIC1/G

OUT OF GOOD CHARGE  
RANGE? ANST CODE  
\*\*\* \*\* \*\*\*\*\*  
N Y PESTP

END OF REPORT

B01-027

9713508.1926

B01-028-MCO 4-30-92

SAMPLE STATUS REPORT FOR E 2307 E-BLANK B06801 TIME: 4/30/92 8:42  
DISPATCHED: 4/14/92 14:22 SAMPLE HAS NOT BEEN SLURPED  
RECEIVED: 4/30/92 7:45

EXT.	DETER.	RESULTS OR STATUS	OUT OF GOOD CHARGE	RANGED ANST	CODE
****	*****	*****	***	***	*****
4271	TOT-ACT	< 5.00000E 01 PICI/G	N	Y	PEJBP

END OF REPORT

B01-028



9713408.1927

606804 mcd 4-30-92

SAMPLE STATUS REPORT FOR E 2308. E-BLANK 606805 TIME: 4/30/92 8:46  
DISPATCHED: 4/14/92 14:22 SAMPLE HAS NOT BEEN SLURPED  
RECEIVED: 4/30/92 7:45

EXT. DETER. RESULTS OR STATUS  
\*\*\*\* \*\*\*\*\*  
4271 TOT-ACT 5.92900E 01 PICI/G

OUT OF GOOD CHARGE  
RANGE ANST CODE  
\*\*\* \*\*  
N PETEF

END OF REPORT

B01-029

SAMPLE RECEIPT FORMDelivered by: Wendy Thompson Date/Time: 5-4-12 11:00<sup>h</sup>Received by: David McCallinCustomer Name or Project: SC0 BPICustomer Sample Number(s): B06809ALO Sample Number(s): 92-06904

1. Customer Chain-of-Custody Form: Present ☒ Absent ☐
2. Additional Shipping Forms (list): LSA analysis request,  
container inspection list
3. Custody Seals on Shipping and/or Sample Containers and their Conditions.

Present ☒ Absent ☐If Present, Condition: good

4. Sample Tag(s) ID Numbers if not Recorded on the Chain-of-Custody Record or on Sample Vial.

Notes: 0455

5. Condition of Shipping Container (i.e., broken container, dented, breached plastic bag, temperature of sample container as defined in Section 3.0 in PNL-ALO-051, etc.)

good

6. Condition of Sample Vials. good

7. Verification of Agreement or Nonagreement of Information on Receiving Documents. na

8. Resolution of Problems or Discrepancies. na

RETURN COMPLETED FORM TO PROJECT MANAGER

**B01-030**

9713508.1929

Westinghouse Hanford Company	CHAIN OF CUSTODY	
Custody Form Initiator <u>M. C. Douglas</u>	Project #: <u>91-019</u>	
Company Contact <u>H. S. Thompson</u>	Telephone <u>(509) 376-2153</u>	
Project Designation/Sampling Locations <u>200-NP-1 Operable Unit</u>	Collection Date <u>4-29-92</u>	
<u>Boring: 216-B-43C</u>	Time <u>1418</u>	
Ice Chest No. <u>#1DA 39</u>	Field Logbook No. <u>WHC-385-12</u>	
Bill of Lading/Airbill No. <u>N/A</u>	Offsite Property No. <u>N/A</u>	
Method of Shipment <u>Hand Carry</u>		
Shipped to <u>329 PHL Laboratory</u> Attn: <u>Nancy Wynhuff</u>		
Possible Sample Hazards/Remarks <u>Sample is radioactive: 180 mRad/hr. No other hazards detected.</u>		
<u>Keep sample chilled. All analyses CLP. See lab statement of work.</u>		
Sample Identification		
<u>B06809</u>		
<u>1, 1000 ml, glass, soil, CLP - Total alpha/beta, GEA, Sr90, Cs137, Co60, Pu239,</u>		
<u>Pu239/240, Ru106</u>		
<input type="checkbox"/> Field Transfer of Custody <div style="display: inline-block; width: 40%; text-align: center;">CHAIN OF POSSESSION</div> <div style="display: inline-block; width: 40%; text-align: right;">(Sign and Print Names)</div>		
Relinquished by: <u>M. C. Douglas</u>	Received by: <u>W.S. Thompson</u>	Date/Time:
<u>Matthew C. Douglas</u>	<u>Nancy S. Thompson</u>	<u>5/4/92 0830</u>
Relinquished by:	Received by:	Date/Time:
<u>Nancy S. Thompson</u>	<u>Diana L. McMullin</u>	<u>5-4-92 11:08</u>
Relinquished by:	Received by:	Date/Time:
Relinquished by:	Received by:	Date/Time:
Final Sample Disposition		
Disposal Method:	Disposed by:	Date/Time:
Comments:		

A-6000-407 (12-90)

B01-031



**B01-032**

SAMPLE RECEIPT FORMDelivered by: Wendy Thompson Date/Time: 5-4-92 11:45 AMReceived by: Sara Robbins/Diana BellofattoCustomer Name or Project: 200-BP-1Customer Sample Number(s): B06809 B06812 B06811 5-4-92ALO Sample Number(s): 92-06904 92-06905

1. Customer Chain-of-Custody Form: Present X Absent
2. Additional Shipping Forms (list): SAR, ORSR
3. Custody Seals on Shipping and/or Sample Containers and their Conditions.  
Present X Absent         
If Present, Condition: intact
4. Sample Tag(s) ID Numbers if not Recorded on the Chain-of-Custody Record or on Sample Vial.  
Notes: good
5. Condition of Shipping Container (i.e., broken container, dented, breached plastic bag, temperature of sample container as defined in Section 3.0 in PNL-ALO-051, etc.)  
good 4°C
6. Condition of Sample Vials.
7. Verification of Agreement or Nonagreement of Information on Receiving Documents.  
N/A
8. Resolution of Problems or Discrepancies.  
N/A

RETURN COMPLETED FORM TO PROJECT MANAGER

B01-033



9713508.1932

Westinghouse Hanford  
Company

## CHAIN OF CUSTODY

Custody Form Initiator M. C. Douglas

Project #: 91-019

Company Contact W. S. Thompson

Telephone (509) 376-2153

Project Designation/Sampling Locations 200-BP-1 Operable UnitCollection Date 4-29-92Boring: 216-B-43CTime: 1418Ice Chest No. #EFS618Field Logbook No. WHC-II-385-12Bill of Lading/Airbill No. II/AOffsite Property No. II/AMethod of Shipment Hand CarryShipped to 325 PNL Laboratory (300 Area) Attn: Diana BellofattoPossible Sample Hazards/Remarks Sample is radioactive: 120ml - 5,500 cpm; 950ml - 3mR/hr.No other hazards detected. Keep sample chilled. All analysis CLP. See lab statement of work.

Sample Identification

B068091, 120 ml, amber glass, Soil, CLP- VOA1, 950 ml, amber glass, Soil, CLP- Semi-VOA, Pest/PCB, TOC☐ Field Transfer of Custody

## CHAIN OF POSSESSION

(Sign and Print Names)

Relinquished by: M. C. Douglas

Received by:

Date/Time:

Matthew C. DouglasWendy L. Thompson5/4/92 0830Relinquished by: W. S. Thompson

Received by:

Date/Time:

11:45 AMWendy L. ThompsonDiana Bellofatto5/4/9212:45 PM

Relinquished by:

Received by:

Date/Time:

Relinquished by:

Received by:

Date/Time:

## Final Sample Disposition

Disposal Method:

Disposed by:

Date/Time:

Comments:

4-6000-407 (12-90)

B01-034





## SAMPLE ANALYSIS REQUEST

## PART I: FIELD SECTION

Collector M. C. Douglas

Date Sampled 4-29-92 Time 1418 hours

Company Contact W.S. Thomson

Telephone (509) 376-2153

[illegible]

Field Information\*\* Sample collected in support of the 200-BP-1, Task 2 & 4, RI/FS  
Project.

Borehole: 216-B-43C

Special Handling and/or Storage Attn: Diana Bellofatto. Keep sample chilled

All analyses CLP. See lab statement of work.

Possible Sample Hazards Sample is radioactive: 120 ml - 5,500 cpm; 950 ml - 3 mR/hr.  
No other hazards detected.

## PART II: LABORATORY SECTION

Received by \_\_\_\_\_ Title \_\_\_\_\_ Date \_\_\_\_\_

Analysis Required \_\_\_\_\_

\*Indicate whether sample is soil, sludge, water, etc.

**\*\*Use back of page for additional information relative to sample location**

▲ 6000 406 (05,20)

**B01'-035**

Westinghouse Hanford Company	CHAIN OF CUSTODY
Custody Form Initiator <u>M. C. Douglas</u>	Project #: <u>91-019</u>
Company Contact: <u>W. S. Thompson</u>	Telephone <u>(509) 376-2153</u>
Project Designation/Sampling Locations <u>200-8P-1 Operable Unit</u>	Collection Date <u>4-29-92, 4-30-92</u>
Boring: <u>216-B-43C</u>	Time: <u>1419, 1030</u>
Ice Chest No. <u>EF3618, SML10</u>	Field Logbook No. <u>WHC-11-385-12</u>
Bill of Lading/Airbill No. <u>11/A</u>	Offsite Property No. <u>11/A</u>
Method of Shipment <u>Hand Carry</u>	
Shipped to <u>325 PNL Laboratory (300 Area) Attn: Jim Robbins</u>	

Possible Sample Hazards/Remarks Sample #1 is radioactive: 5,000 cpm. No other hazards detected. Keep samples chilled. All analyses CLP. See lab statement of work. Sample #2 is nonhazardous.

## Sample Identification

① B06809

1, 125 ml, glass, soil, CLP - Total Cn, Free Cn, Ferro Cn, ICP/AA metals, Ice/ms, Bi, Tc99, NO<sub>3</sub>, SO<sub>4</sub>, PO<sub>4</sub>, Total Uranium

② B06812

1, 125 ml, glass, soil, CLP - Total Cn, Free Cn, Ferro Cn

Field Transfer of Custody		CHAIN OF POSSESSION	(Sign and Print Names)
Relinquished by: <u>M. C. Douglas</u>	Received by: <u>W. S. Thompson</u>	Date/Time: <u>5/4/92 0830</u>	
<u>Matthew C. Douglas</u>	<u>W. S. Thompson</u>		
Relinquished by: <u>W. S. Thompson</u>	Received by: <u>J. Robbins</u>	Date/Time: <u>5/4/92 11:45</u>	
<u>W. S. Thompson</u>	<u>J. Robbins</u>		
Relinquished by:	Received by:	Date/Time:	
Relinquished by:	Received by:	Date/Time:	

## Final Sample Disposition

Disposal Method:	Disposed by:	Date/Time:
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Comments:





## SAMPLE ANALYSIS REQUEST

## PART I: FIELD SECTION

Telephone (509) 376-2153

PART II: LABORATORY SECTION

Analysis Required PARAMETERS OF INTEREST

**B01-037**





## ALO CHAIN OF CUSTODY

	<u>92-06428</u> ALO SAMPLE NUMBER	<u>Pesticides</u> <u>Organic-SVOA, TOC, PCB</u> ANALYSIS REQUESTED	<u>B067Y5 SOIL</u> SAMPLE DESCRIPTION
SENDER	<u>Rich A. Steele</u>		<u>4/22/92</u> DATE
RECEIVER	<u>Donna Z. Bell</u>		<u>4/22/92</u> DATE

	<u>ALO SAMPLE NUMBER</u>	<u>ANALYSIS REQUESTED</u>	<u>SAMPLE DESCRIPTION</u>
SENDER	_____		_____ DATE
RECEIVER	_____		_____ DATE

	<u>ALO SAMPLE NUMBER</u>	<u>ANALYSIS REQUESTED</u>	<u>SAMPLE DESCRIPTION</u>
SENDER	_____		_____ DATE
RECEIVER	_____		_____ DATE

	<u>ALO SAMPLE NUMBER</u>	<u>ANALYSIS REQUESTED</u>	<u>SAMPLE DESCRIPTION</u>
SENDER	_____		_____ DATE
RECEIVER	_____		_____ DATE

Original - Project Management Office  
 Copy - Sender  
 Copy - Receiver

Applicable Test Instruction  
TI-200BP-1-200

<u>92-06428</u> ALO SAMPLE NUMBER	<u>Inorganic</u> ANALYSIS REQUESTED	<u>B067Y5 SOIL</u> SAMPLE DESCRIPTION
SENDER <u>[Signature]</u>		<u>4/28/92</u> DATE
RECEIVER <u>[Signature]</u>		<u>4-28-92</u> DATE

<u>ALO SAMPLE NUMBER</u>	<u>ANALYSIS REQUESTED</u>	<u>SAMPLE DESCRIPTION</u>
SENDER _____		_____ DATE
RECEIVER _____		_____ DATE

<u>ALO SAMPLE NUMBER</u>	<u>ANALYSIS REQUESTED</u>	<u>SAMPLE DESCRIPTION</u>
SENDER _____		_____ DATE
RECEIVER _____		_____ DATE

<u>ALO SAMPLE NUMBER</u>	<u>ANALYSIS REQUESTED</u>	<u>SAMPLE DESCRIPTION</u>
SENDER _____		_____ DATE
RECEIVER _____		_____ DATE

Original - Project Management Office  
 Copy - Sender  
 Copy - Receiver

Applicable Test Instruction  
TI-200BP-1-198



<u>92-06428</u> ALO SAMPLE NUMBER	<u>RadChem</u> ANALYSIS REQUESTED	<u>B067Y5 SOIL</u> SAMPLE DESCRIPTION
SENDER <u>Richard L. Steele</u>		<u>5/20/92</u> DATE
RECEIVER <u>Robert J. Williams</u>		<u>5-20-92</u> DATE

<u>ALO SAMPLE NUMBER</u>	<u>ANALYSIS REQUESTED</u>	<u>SAMPLE DESCRIPTION</u>
SENDER _____		DATE _____
RECEIVER _____		DATE _____

<u>ALO SAMPLE NUMBER</u>	<u>ANALYSIS REQUESTED</u>	<u>SAMPLE DESCRIPTION</u>
SENDER _____		DATE _____
RECEIVER _____		DATE _____

<u>ALO SAMPLE NUMBER</u>	<u>ANALYSIS REQUESTED</u>	<u>SAMPLE DESCRIPTION</u>
SENDER _____		DATE _____
RECEIVER _____		DATE _____

Original - Project Management Office  
 Copy - Sender  
 Copy - Receiver

Applicable Test Instruction  
TI-200BP-1-199